GREEN ENERGY PRODUCT MARKETING: A STUDY WITH REFERENCE TO OFF-GRID SOLAR ROOFTOP PHOTOVOLTAIC POWER PLANT (RTPV) IN KERALA

Thesis submitted to the

UNIVERSITY OF CALICUT

for the award of the degree of

DOCTOR OF PHILOSOPHY IN COMMERCE

UNDER THE FACULTY OF COMMERCE AND MANAGEMENT STUDIES

By

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I hereby declare that this thesis titled "**Green Energy Product Marketing: A Study with Reference to Off-Grid Solar Rooftop Photovoltaic Power Plant (RTPV) in Kerala**", submitted to University of Calicut, for the award of Degree of Doctor of Philosophy in Commerce, is a record of the bonafide research work done by me under the supervision and guidance of **Dr. Philo Francis**, Associate Professor (Retd.), Research & PG Department of Commerce, St. Joseph's College, Irinjalakuda, Thrissur.

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ABBREVIATIONS

ADB	Asian Development Bank
AGR	Average Growth Rate
AMA	American Marketing Association
ANERT	Agency for Nonconventional Energy and Rural Technology
APB	Actual Purchasing Behaviour
AWA	Awareness
ATGI	Attitude towards Government Initiatives
ATESP	Attitude Towards Environmentally Sustainable Products
BIPV	Building Integrated Photovoltaic
BNEF	Bloomberg New Energy Finance
BSR	Buyer Social Responsibility
CAI	Continued Adoption Intention
CAGR	Compound Annual Growth Rate
CB	Consumer Behaviour
CC	Carbon Credit
CDM:	Clean Development Mechanism
CER	Certificate of Emission Reduction
CERC	Central Elecricity Regulatory Authority
CLV	Customer Lifetime Value
CFA	Confirmatory Factor Analysis
CM	Carbon Market
Co2	Carbon Emission
C/D	Confirmation/Disconfirmation
COMN	Communication
CON	Convenience
COP 21	Conference of Parties
CPA	Customer Profitability Analysis
CUI	Continued Usage Intention
ACiM	Continuance Intention Model
CRM	Customer Relationship Management
CREDA	Chhattisgarh State Renewable Energy Development Agency
DISCOM	Distribution Companies
DITN	Distribution

DOI	Diffusion of Innovation
EA	Environmental
EF	Economic Factors
ECCB	Ecologically Conscious Consumer Behavior scores
EFP	Environment Friendly Products
EFGS	Environment Friendly Goods and Services
EIA	Environment Impact Assessment
ELV	Emission Limit Value
EMC	Energy Management Centre
ENGO	Environmental Non Governmental Organization
EOU	Ease of Use
ERT	Expert Review Team
ESP	Environmentally Sustainable Product
GBI	Generation Based Incentives
GERT	Greenhouse Gas Emission Reduction Trading Project
GHG	Green House Gas Emission
GoI:	Government of India
GIMG	Green Innovative Micro Generation
GW	Giga Watt
GPB	Green Purchasing Behaviour
GPD	Green Purchasing Decision
GPI	Green Purchase Intention
HITC	High Involvement Technologically Complex
IDT	Innovation Diffusion Theory
IEA	International Energy Agency
IET	International Emission Trading
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
IREDA	Indian Renewable Energy Development Agency
IRENA	International Renewable Energy Agency
IRMG	Innovative Renewable Micro Generation
ISA	International Solar Alliance
JNNSM	Jawaharlal Nehru National Solar Mission
KSEBL	Kerala State Electricity Board Limited

KREEPA	Kerala Renewable Energy Entrepreneurs Association
KW	Kilo Watt
LOHAS:	Lifestyle of Health and Sustainability
LDCs	Lower Development Countries
LZC	Low or Zero Carbon
MDG	Millineum Development Goals
MEZ	Micro Enterprise Zone
MGT	Micro Generation Technology
MNRE	Ministry of New and Renewable Energy
MoE	Ministry of Environment
MTPA	Million Tonnes Per Annum
MW	Mega watt
MWEQ	Mega Watt Equivalent
NAPCC	National Action Plan on Climate Change
NGO	Non Government Organisation
NOS	National Occupation Standards
NSM	National Solar Mission
NAM	Norm Activation Model
NCAER	National Council for Applied Economic Research
OECD	Organisation of Economic Cooperation and Development
PAYG	Pay As You Go
PAGI	Positive Attitude towards Green Innovation
PRI	Price
PRO	Product quality
PU	Perceived Usefulness
PV	Photo Voltaic
PBC	Perceived Behavioural Control
PN	Personal Norm
PWOM	Positive Word of Mouth
QSP	Quality, Service, Price
R&D	Research & Development
RA	Relative Advantage
RE	Renewable Energy
RES	Renewable Energy Source

RET	Renewable Energy Technology
RECAI	RE Country Attractiveness Index
RMN	Recommendation
ROC	Renewable Obligation Certificate
RPB	Repeat Purchase Behaviour
RPO	Renewable Portfolio Obligation
RTPV	Roof Top Photovoltaic
SAT	Satisfaction
SCRC	State Electricity Regulatory Commission
SECI	Solar Energy Corporation of India
SEPs	Solar Energy Developers
SERC	State Electricity Regulatory Commission
SET	Sustainable Energy Technology
SEZ	Special Economic Zone
SEM	Structural Equation Model
SWS	Solar Water System
SHS	Solar Home Systems
SN	Subjective Norm
SNA	State Nodal Agency
SOA	Service Oriented Aspects
SPV	Solar photovoltaic
TAM	Technology Acceptance Model
TERI	The Energy and Research Institute
TOD	Time of the Day
TPB	Theory of Planned Behaviour
TQM	Total Quality Method
TRA	theory of Reasoned Action
UNFCCC	United Nations Framework on Climate Change
USP	Unique Selling Proposition
VBN	Value Norm Theory
WISE	World Institute of Sustainable Energy
WTP	Willingness to Purchase

CHAPTER 1

INTRODUCTION

CHAPTER – 1

INTRODUCTION

1.1 Introduction

A radical transformation from grey energy to green energy is happening at global and national levels as a result of the shifting phenomenon in the mindset of the people towards green consumption behavior. Climate change issues and the consequent global warming also contribute to it. The ever rising population and increased release of CO_2 are identified as the major reasons for the climate change and global warming. Among the various types of energy usage, the contribution of electrical energy to CO_2 generation by burning fossil fuels can be reduced by including Renewable Energy Technology (RET) in our energy mix. RETs are absolutely necessary to create a clean, green, less carbon intensive dynamic world which enables us to achieve energy self reliance and environmental sustainability.

When considering the Indian Renewable Energy (RE) scenario, the support for RETs started from the sixth Five Year Plan (1980-85) and green energy gets momentum due to the fiscal policy interventions by the government and also assistance from bilateral, multi-lateral and multi-national corporations. Globally the investment in RE reached a total of $279 billion in 2017 (REN 21, 2018). India has an ambitious plan for decarbonization of energy sector by incorporating various Renewable Energy (RE) programmes. According to International Energy Agency (IEA), Indian clean energy sector investment will rise up to $ 900 billion by 2035. India ranks fourth among the 55 developing nations in renewable energy investment. Now India stands third in RE Country Attractiveness Index (RECAI). Among all energy sources, solar energy is recognized as the most gifted due to its profusion and widespread accessibility, reliability and possibility for decentralized use. Solar energy is inexhaustible, carbon- free source of energy and can fuel our present and future energy needs.

According to MNRE Ministry of New and Renewable Energy (MNRE), India, being a tropical country receives about 300 sunny days in a year subsequently receiving more than 500 trillion KW a year, and it is far higher than the total

electricity utilization of the country. On an average, generation of 1000Kwh of electricity from solar radiation reduces emissions about 83.6 kg of sulpher dioxide, 2.25 kg of nitrogen oxide and 635kg of carbon dioxide. During its 20 year life time a solar rooftop system can reduce tonnes of poisonous gas in the atmosphere. (Ramachandra, Ganesh Hedge and Goutham Krishna Das, (2014). The Government of India is encouraging solar energy through a variety of strategies as part of offsetting carbon footprints. The Government of India initiated the National Action Plan on Climate Change (NAPCC) which was released on 30th June, 2008 to declare India's involvement infighting climate change. The ultimate objective of Jawaharlal Nehru National Solar Mission (JNNSM), one of the eight national missions under NAPCC, is to augment the share of solar energy in the total energy blend and make the solar energy competitive with fossil- based energy options. India can build solar energy as the backbone of its economy by 2050 and has a target of achieving 175 GW RE by 2022 and further enhancement of 250 GW by 2030. From this 175 GW, 100 GW will be procured only from solar energy. These renewable energy targets can reduce 170 million tonnes of CO_2 during its life cycle.

Solar energy has witnessed a phenomenal growth in recent years all over the world because of the growing environmental concern, and also of the Government supportive measures coupled with cost reduction. There has been a significant growth in India's solar market, particularly in solar PV, after the launch of the JNNSM in 2010.According to MNRE, India has set up cumulative solar installations of 16611.73 MW as on Nov.2017 out of which solar rooftop segment contributes about 863.92 MW.

Looking at the Indian solar energy scenario**,** the government's solar program is run by the Ministry of New and Renewable Energy (MNRE). It is remarkable that India is the only country with a full-fledged ministry for renewable energy. In a study conducted by the World Institute of Sustainable Energy (WISE, 2013), it was found that 95 per cent of energy requirements of Kerala could be met through RE sources by 2050. "ANERT" (Agency for Non Conventional Energy and Rural Technology) is the State Nodal Agency (SNA) of the Central Ministry working under the Department of Power, Government of Kerala, paying attention to programs for the progress and popularization of RE. 10000 roof top solar program of ANERT is getting better

response from Kerala. State DISCOM (KSEB), SNA (ANERT) many Public Sector Units (PSUs), and Non Governmental Organizations (NGOs) also focus on solar energy programs and are also engaged in solar energy propagation.

(Follows & Jobber, 2000) defines that green energy product market indicates the market for renewable /sustainable energy product. As suggested by (Ottman, 1998), (Suki, 2013) observed that a green product is characterized by harmless, naturally grown, recyclable, not tested on animals, non-polluting the environment, minimum package, contains natural components, and approved chemicals. This research considers renewable energy, especially solar energy products, as green products considering their clean, environment-friendly, non- toxic, Green House Gas (GHG) reduction. Some people may recognize green as something related to organic nature and some treat it as pollution-free. A product becomes green when it follows green activities in all stages of production, i.e. from acquisition of raw materials to even after their disposal. Environmentalism is a universal remedy for the marketers, who ignore the impact of consumption on society. According to American Marketing Association (AMA), Green marketing is the marketing of environmentally safe products and green consumers are the persons who possess a high environmental consciousness. Rapid development of green products as a substitute for conventional products is remarkable and consumer enlightment on environmental issues promotes green energy products. This became an opportunity for the suppliers with social goals.

Deep understanding of Consumer Behaviour (CB) is necessary for the success of marketing programmes of innovative green energy products and it helps in improving the quality of these existing products which would also serve as a competitive advantage. In addition to that, understanding CB is necessary for the formulation and redesigning of public policy. It also helps the marketers to identify market segments by analyzing demographic characteristics and geographical boundaries and to keep up the existing market share and to increase the market potential. The role of consumers becomes more crucial because they must exercise their rationality while making high involvement decision especially for an innovative technological product. Even though there is a possibility of direct relationship between environmental consumerism and pro-environmental behavior, empirical

literature related to green products commercialization has identified a significant gap between concern and actual purchase.

1.2 Significance of the study

The accomplishment of environmental sustainability is impossible without development of efficient, sustainable non polluting sources of energy, because it is the key input for the technological, social, industrial and economic development of a nation. Electricity generation by utilizing solar energy is promising, reliable and suitable for decentralized applications. When compared with developed nations, India has less carbon emission but in the coming decades, India will account for more emission due to fast industrialization and economic growth. Solar energy not only provides a clean, green and sustainable form of energy but also has a vast potential to create employment in rural communities. Solar energy can lessen many public health risks caused by the mining, manufacture and burning of fossil fuels, thereby reducing the impacts on global bio diversity and eco system.

Solar Rooftop Photovoltaic (RTPV) could be used as a decentralized energy system to electrify individual houses or communities, schools, hospitals, street lights and agricultural pumps**.** All RETs including hydro-electricity originate from sun power. The most potential applications of Solar Photovoltaic (PV) cells can be seen in developing countries. High initial cost of SPV turns out to be economical on a life cycle cost basis analysis with alternative forms of energy. Government supportive measures, reduction in costs, improvement in system efficiency, reliability, life expectancy and a behavioural change in the mindset of people for favorable attitude towards green energy would make Solar Photovoltaic (SPV) a more economical and attractive option for decentralized applications. Literature identified the economic and financial reasons which proved a major barrier for its adaptation and environmental factors as drivers for adoption. Therefore it is relevant to measure the consumer awareness, interest and product acceptance and post adoption behavior in the context of RTPV.

1.3 Statement of Problem

Even though Kerala was a power surplus state till 1980s, the state is currently experiencing acute power shortage and has started purchasing thermal energy from central pool for meeting its electricity demand due to population growth and standard of living. Kerala generates power from four sources-hydro power, thermal power, wind power and solar power. Of these, hydel and thermal power generations account for the bulk, whereas wind and solar power generations make only marginal additions. Each unit of thermal electricity would mean 900gm of carbon dioxide in the atmosphere, thereby adding to global warming. Monsoon rain is essential to sustain the hydropower base in the State and the deficit in rainfall usually creates a power crisis. Moreover, the generation of power from hydro projects which are the major source of Kerala, is not possible due to ecological problems. In Kerala, shortage of power is the prime obstacle in starting new industrial units. 'KSEB's own generation accounts for about 44 per cent of the total energy sold, while 52 per cent comes from central power generating stations, and traders, often at higher prices" (The Energy Report-Kerala, WWF & WISE 2013).

Even though the state has also been forced to purchase more power from central power generating stations, it has been observed that the state's power requirements could not be met fully from hydel projects alone (Parameswaran, M.P 1990). According to the Planning Commission, there are 66 lakh houses in Kerala. As per 'Keralapadanam'(2013), a study conducted by KSSP (Kerala Sasthra Sahitya Parished) 10 per cent of these houses belong to the rich and 40 per cent belong to the upper middle class. According to an Energy Management Centre (EMC) study, there are 20 lakh houses with inverters. Moreover, large hydro projects are not advisable further as they are recognized as a threat to bio-diversity. Micro generation technology like solar rooftop power plant is an innovative sustainable energy technology which can provide a solution to the energy crisis, but the share of low carbon technology is negligible in Kerala.

Kerala has the highest share of household electricity consumption among the states in India. 78.49 per cent of the consumers are in the household sector. Also the distribution and transmission losses are about 30 per cent and it is certainly

inadequate, inefficient, and wasteful. The state Government of Kerala introduced its draft solar policy for 2013 with a mission for 500 MW of new solar by 2017 and 1.5 GW by 2030. The policy also calls for the mandatory installation of RTPV in houses with more than 2500 sq. ft area. As per solar radiation analysis, (METEONORM) the values of Global Solar Irradiance (GHI) of the state indicates that SPV technology is more suitable for the State than thermal technology. WWF& WISE 2013 states "The GHI daily average value of the state is 4.49 kwh/m^2/day and annual value 2003 kwh/m^2/day. Any site with GHI more than 1500 kwh/m^2/year is suitable for solar PV technology". The evaluation of WISE indicates the total potential for decentralized solar PV power packs for household sector is about 13079 MW, while for the institutional or commercial sector it is about 18066 MW. Thus the summative potential for decentralized solar PV power packs is calculated at 31145 MW (The Energy Report - Kerala, WWF & WISE 2013). But according to MNRE sources the installed capacity of solar energy in Kerala was 12.03 MW (2015) and it became 15 MW in 2016. But the challenge lies here in the compulsory implementation of the policies. In developing and developed countries where government becomes more strict in imposing regulations to protect environment, while the customers of these countries being more aware, they demand environment-friendly products, even though the question remains on their willingness to pay higher premium for these products. Scarcity of land in Kerala is a hurdle to installing large solar power plants, so rooftop solar power plants are the answer to this problem. It can be installed on the rooftop of the buildings, both domestic and non- domestic sector. Its initial capital requirement and high payback period restrict more people from adopting this sustainable innovative technology. (Lokhande, 2012) states that even though prices of solar equipment are high, there is great benefit in terms of saving over a period, viz, 20 to 30 years. For installing 1 KW power plant a person has to pay around one lakh rupees even after government subsidy. Although Kerala known for its 100 per cent literacy, a large segment of the population is unaware of this technology and is not coming forward to adopt this innovative technology.

At the same time a small segment of the population is coming forward to adopt 1KW RTPV through 10,000 rooftop program of the Government. It should be noted that some are also showing interest by applying ANERT's new 'solar connect'

programme which is for on-grid power plant. Most innovating companies came across the problem of consumer resistance to adopting green innovation in their marketing effort. Further, the study found that house owners were not completely rational while making purchase or investment decisions, but are influenced by factors other than cost benefit. Some people have already installed power plant without government subsidy. Being green alone is not enough to achieve success in the market (Averdung and Wagenfeuhrer, 2011), (Kalafatis et al., 1999). Therefore an in-depth understanding of consumer behavior is required to forecast market acceptance of an environmentally sustainable innovation. As this involves technology and sociology, user acceptance of new technology is critical to bean the apt research topic.

As suggested by (Shrum et al., 1995), (Averdung and Wagenfeuhrer, 2011), mentioned that claiming to be environmentally sustainable by a pioneering product is always regarded as distrustful and customers view it with skepticism. So in this era, consumer determines the fate of a product, and hence it is highly relevant to study the determinants of actual purchase behavior of SPV users, their post purchase behavior and the barriers faced by the marketers of SPV in Kerala. There has been no comprehensive research on the factors that influence consumer behavior towards the adoption of SPV and their post- purchase behavior .The present study concentrates on this direction and also tries to find out whether SPV purchasers/adopters get satisfaction which leads to further adoption in terms of capacity addition. Hence it is necessary to understand the behavioral aspects of acceptance and consumption of such products.

1.4 Research Gap

There has been little attempt to academically examine the consumer adoption behaviour of solar energy products even at the national level. There is no study in Kerala which specifically analyzes the pre and post adoption behavior of users and barriers for penetration of Rooftop Photovoltaic (RTPV). There are several studies in the past for examining the scope of marketing renewable energy products by studying the attitude towards Renewable Energy (REs). Studies concerned with energy sector and environmental issues are also done by the researchers. However, the link between pre and post adoption behavior specifically for off grid RTPV and adoption barriers

were not tried by any of the scholars earlier. Moreover in the current context, it is very urgent not only for companies but also for government to devise green strategies which do not harm the environment. Therefore the current study becomes very important which mainly focuses on both pre and post adoption behaviour which is necessary for its long term market success.

1.5 Research Questions:

1. What are the determinants of purchase decision of SPV by the users?
2. Are they satisfied with the product?
3. Will this satisfaction lead to Continued Adoption Intention (CAI)?
4. Do the pre- adoption factors have an impact on CAI?
5. What are the challenges for solar energy penetration in Kerala?

1.6 Research Objectives:

1. To develop a model explaining the adoption behaviour of Rooftop Photovoltaic (RTPV) consumers in Kerala.
2. To study the influence of the factors which drive pre adoption behavior towards Rooftop Photovoltaic.
3. To study the influence of the factors which drive post adoption behavior towards Rooftop Photovoltaic.
4. To identify the barriers faced by Rooftop Photovoltaic dealers in Kerala.

1.7 Research Hypotheses

The review of literature proves that many authors considered either pre-purchase factors or post purchase factors in their research works separately; however, very few studies taken these factors simultaneously**.** Based on the literature review and theoretical review, the following research hypotheses are proposed for the study.

Objective 1:

H1. Product oriented aspects has a positive impact on satisfaction.

H2. Price oriented aspects has a positive impact on satisfaction.

H3. Communication has a positive impact on satisfaction.

H4. Convenience aspects has a positive impact on satisfaction.

H5. Service oriented aspects has a positive impact on satisfaction.

H6. Ease of Use has a positive impact on satisfaction.

H7. Satisfaction has a positive impact on continued adoption intention.

H8. Awareness regarding RTPV has a positive impact on continued adoption intention.

H9. Economic Factors has a positive impact on continued adoption intention.

H10. Attitude towards Government Initiatives has a positive impact on continued adoption intention.

H11. Environmental Attitude/ Relative Advantage has a positive impact on continued adoption intention.

H12. Buyer Social Responsibility has a positive impact on continued adoption intention.

H13. Perceived Usefulness has a positive impact on continued adoption intention.

H14. Subjective Norms has a positive impact on continued adoption intention.

H15. Continued adoption intention has a positive impact on Repeated Purchase Behavior.

H16. Continued adoption intention has a positive impact on Positive Word of Mouth.

Objective 2:

H17: The involvement of pre adoption factors in actual RTPV adoption among consumers is significant in Kerala.

Objective 3:

H18: The satisfaction regarding RTPV system among consumers is significant in Kerala.

Objective 4:

H 19: The barriers faced by the RTPV dealers in Kerala is significant

H 20: Socio demographic variables can significantly impact adoption behaviour of RTPV consumers.

1.8 Scope of the Study:

The research attempts to determine the influencing factors and satisfaction of the SPV customers in Kerala and to identify the major barriers to its penetration. The study covers the following:

1. This research attempts to concentrate only on one Renewable Energy Technology viz, 1 KW Off-grid Rooftop Solar Photovoltaic Power Plant. Other RETs not considered.
2. The customers for Solar Photovoltaic (SPV) can be divided into domestic and non-domestic. Non-domestic customers include government institutions, educational institutions, and hospitals, commercial and industrial enterprises. The non- domestic customers were excluded from the research. The scope of the study is limited to assessing the determinants and satisfaction of domestic SPV consumers of 10000 solar power plant schemes in Kerala and to identifying the barriers faced by companies and dealers to marketing SPV in Kerala. All the Kerala based companies included in the MNRE channel partnership based on rating criteria, KW installation and dealers of non Kerala companies dealers included in the 10000 power plant programme were considered for the purpose of studying the challenges in this market.
3. This application may be of mainly two types: off-grid and on-grid. Off-Grid PV is equipped with batteries for storage of energy which is generated during day time and has no interaction with grid. On the other hand, on-grid PV is connected to the grid for exporting the excess power produced by the consumer and can import the power if they need. Its working is based on net metering policy and the consumer benefited with a financial reimbursement. In this research, Off-grid Rooftop Solar Photovoltaic (RTPV-typically 1 KW domestic installation) is taken in to consideration.

4. Beneficiaries of '10000 solar rooftop programme' which is subsidy- driven market are only considered for this study.

Here, on- grid type is excluded because, in Kerala, penetration of the same is much less compared to off-grid. Utilities (DISCOMS) in Kerala have to make better infrastructure for allowing on-grid facility to domestic consumers. At the same time, there are many technical problems like inter connection metering, grid capacity etc. However, the SNA of MNRE - ANERT has started in joint hand with KSEB's 'solar connect programme' in which consumers can apply for on-grid solar PV. So on-grid SPV is in an emerging experiment and the procedures and functioning of that system are entirely different.

Similarly the researcher considers the RTPV market as subsidy driven and private. As the lack of authenticity in data, and solar scams and consequent controversies are ongoing in Kerala during the time of research period, the researcher strictly lays emphasis on the subsidy- driven market for this research.

1.9 Conceptual Research Framework

A brief explanation of conceptual framework has been given below and detailed clarification of constructs and theoretical links involved in the model has given in 4th chapter**.**

The objective of the present study is to analyze those factors which influence the desire to buy SPV with Structural Equation Modeling. This research proposed a conceptual model which also adopted constructs from various theories like Technology Acceptance Model (TAM) originally devised by (Davis, 1989) with its origins in the Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB) (Ajzen, 1991), DOI (Roger, 1995). For the model approval Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) have been used. These motives have been selected through an extensive review of the previous researches in this field. The proposed model will examine the effect of pre adoption factors on CAI and the effect of SAT on CAI and subsequent outcome variables. Broad literature review helped in producing insight and systematizing the confirmed critical relationship among variables. These theories

are widely used by the researchers for studying the consumer acceptance of environmentally sustainable innovations. The objective of this research also tried to explain post-adoption behavior of SVP rather than the initial purchase itself. The model tries to study the effect of awareness, Environmental Attitude /Relative Advantage, Economic Factors, Buyer Social Responsibility, Attitude towards Government Initiatives, Perceived Usefulness, Subjective norm on CAI, Satisfaction through Product, Price, Distribution, Communication, Perceived Ease of Use, Service Quality related factors and also the effect of SAT on CAI and subsequent outcome variables RPB (Repeated Purchase Behaviour) and PWOM (Positive Word of Mouth)

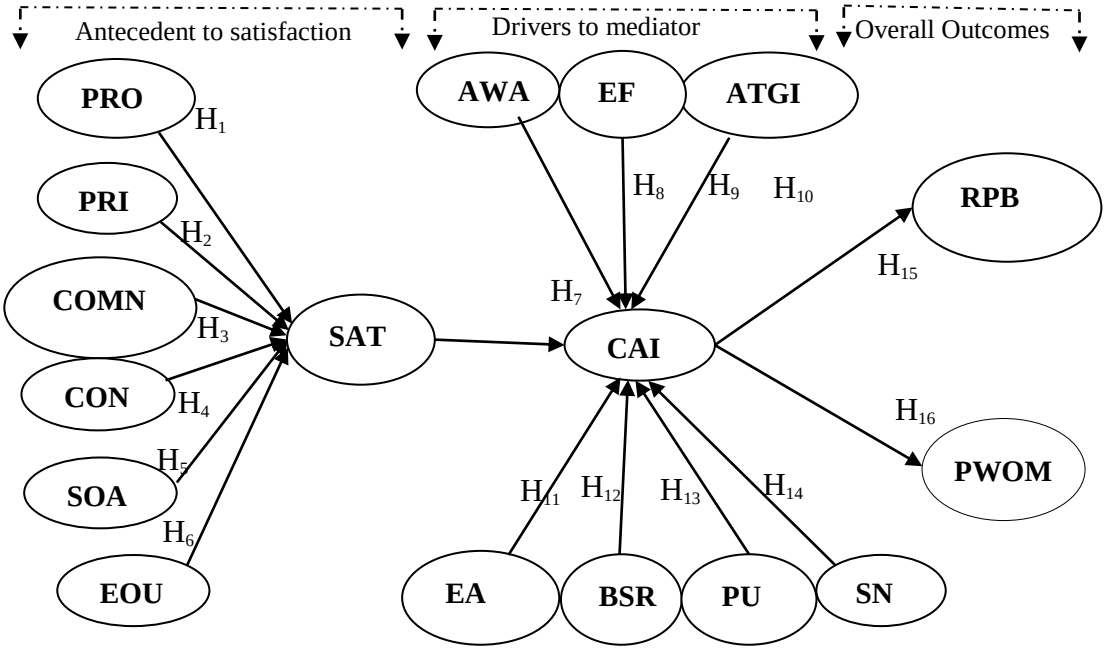

Figure:1.1

Conceptual Framework Showing the Study Hypotheses (Antecedents and Consequences of RTPV Adoption)

Note: SAT=Satisfaction, PRO=Product Oriented Aspects, PRI=Price Oriented Aspects, COMN=Communication, CON=Convenience, SOA=Service Oriented Aspects, EOU=Ease of Use, AWA=Awareness regarding RTPV, EF=Economic Factors, ATGI=Attitude towards Government Initiatives, EA=Environmental Attitude/ Relative Advantage, BSR=Buyer Social Responsibility, PU=Perceived

Usefulness, S=Subjective Norms, CAI=Continued Adoption Intention, RPB= Repeated Purchase Behavior, PWOM=Positive Word of Mouth.

1.10 Operational Definitions

Solar Technology - It is a green energy technology used to capture sun's energy to produce electricity

Off-Grid Rooftop Solar photovoltaic power plant (RTPV)

Off-grid RTPV accompanied by battery backup for storing electricity generated during the day which can be used at night time. It is an innovative renewable energy system/product which uses photovoltaic effect to convert the sun's energy into electricity. Solar PV is an innovative renewable micro generation technology also known as stand alone SPV, distributive form of energy, and Micro Generation Technology (MGT) that can bring significant reduction to Co_2.

Domestic/Residential User

Domestic consumers are household consumers who adopted RTPV.

Actual Purchase Behavior (APB)/Adoption

Purchase/acquisition, installation and use of RTPV by consumers are treated as adoption. Consumer buying behavior/adoption behavior is the behavior exhibited by the individual/household consumer while purchasing or adopting a product. Here APB described as the integration function of {AWA (Awareness/Knowledge) +EF (Economic Factors)+RA/EA (Relative Advantage / Environmental Attitude) + BSR (Buyer Social Responsibility)+PU (Perceived Usefulness)+SN (Subjective Norms)+ATGI (Attitude Towards Government Initiatives)}.

Continued Adoption Intention (CAI)

It is the likelihood of a person's intention to continue with the adopted technological product for their entire life or treated as a part of their life

Repeat Purchase Behavior/ Re-adoption (RPB)

Is a form of behavioral loyalty exhibited by the consumers through the willingness to accept further capacity addition of their existing system and to pay a higher premium for the same. The degree to which one person believes that he/she will indulge/act repurchase or readopt SPV in future in terms of adding more capacity. (e.g: from 1 KW to 2 or 3 KW)

Recommendation/Positive Word of Mouth (RMN/PWOM/ALTRUISM)

It is an attitudinal form of loyalty. Customer's recommendation of the product to other people, such as friends, colleagues is termed as Positive Word of Mouth (PWOM) or Altruism.

1.11 Research Methodology

Obviously, SPV customers are classified into

- Domestic
- Non- domestic

'Domestic' implies residential consumers and 'non-domestic' consumers including government institutions, hospitals, hotels, educational institutions, and private enterprises. In this research, only domestic customers are taken into consideration. The present research is focused on studying the pre and post adoption behavior and also the barriers faced by companies in SPV market in Kerala.

1.11.1 Method of Research

The research work follows both descriptive and analytical nature. Survey research uses a well structured questionnaire for randomly selected RTPV consumers from ANERT list and an interview schedule for dealers.

1.11.2 Period of the study

A pre-pilot study has been conducted to know about the solar energy dealers or companies who are operating in Kerala and also about RTPV customers to identify key variables and factors affecting the key variables in Kerala. Then a pilot study was

conducted among 50 customers with an interview schedule for a period of two months.

1.11.3 Sources of Data

This study is based on primary as well as secondary data from various published documents**.**

A. Secondary Sources:

Magazines: Akshaya Urja, Energy Next, Green Energy

Research Journals: Elsevier, Emerald, Science Direct

Reports: Agency for Non conventional Energy and Rural Technology (ANERT) annual reports, Ministry of New and Renewable Energy (MNRE) website, World Institute of Sustainable Energy (WISE) report, Study Reports of TERI, World Bank(WB), IRENA, KSSP,REN, IEA, Economic Review of State Planning Board Research Dissertations and Theses.

B. Primary data

The first step was to measure the awareness, influencing factors for purchase decision of RTPV as well as for selecting the company, satisfaction and their post purchase behavior of domestic customers towards RTPV. Secondly, barriers faced by SPV companies or dealers in Kerala who are dealing with RTPV installations. Primary data have been collected from the SPV consumers who have adopted 1KW system through 10000 solar roof top programme of ANERT.

1.11.4 Sample Design for SPV Consumers

The sample design for the present study is described in detail: Population includes household users and SPV companies/dealers in Kerala. The researcher selects 10000 rooftop power plant programme because it is one of the ambitious programmes which was initially tried by Kerala and this scheme has already created a market for SPV power plants. All Kerala based companies included in MNRE channel partners and non Kerala company dealers included in the 10000 rooftop solar power plant programme are reckoned.

After the pilot study, reliability testing and finalization of sample size, the final questionnaire was administered to 400 randomly selected consumers from ANERT list, out of which 315 were collected.

A. Target Population

The 10000 roof top solar programme beneficiaries of Kerala are 1 KW system owners**.** Details of population are given below in table 1.1

Table No. 1.1

10,000 Rooftop Solar Power Plant Programme Achievement

Sl.no	District	No.of beneficiaries
1	Thiruvananthapuram	833
2	Kollam	573
3	Pathanamthitta	319
4	Alappuzha	361
5	Kottayam	573
6	Idukki	106
7	Ernakulam	901
8	Thrissur	790
9	Palakkad	373
10	Malappuram	540
11	Kozhikode	509
12	Wayanad	83
13	Kannur	261
14	Kasaragod	178
	Total	**6400**
Source: ANERT Programmes 2013-14-An Overview,2013		

B. Sample procedures:

The study population consists of households who adopted SPV system through 10000 rooftop power plant program within Kerala. A random sample of 315 respondents was selected through Multi Stage Random Sampling Method. A survey

was marked to the customer to capture their awareness, determinants for SPV adoption, satisfaction and post adoption behavior regarding SPV. For selecting consumers, focus was given to beneficiaries of 10000 off-grid solar rooftop SPV power plant scheme which was the first joint initiative of central and state government of Kerala. The beneficiary list including 6400 customers will constitute the sampling frame for the study. The survey intended to ask the consumers/respondents to indicate their opinions regarding their, SAT, CAI, RPB and PWOM intention.

The sample frame of the study consists of SPV beneficiaries of 10000 programme from four districts of Kerala. The researcher selected four districts based on the highest number of SPV installation. The SPV district wise installation is shown in table 1.2. For selecting customers, Multi Stage Random Sampling technique was adopted.

In the first stage, districts in Kerala are divided into two groups: high installation districts and low installation on the basis of RTPV installations in Kerala through '10000 rooftop solar programme'. At the second stage, the researcher selected four districts randomly, i.e. Thiruvananthapuram, Ernakulam, Thrissur, Malappuram based on higher number of SPV installations. At the third stage, the researcher randomly selected the sampling units from the district-wise list of RTPV consumers from the ANERT. Thus the sample frame contains a final sample of 315.

Table No. 1.2

Sample Frame

Sl.no	District	No.of beneficiaries
1	Thiruvananthapuram	833
2	Ernakulam	901
3	Thrissur	790
4	Malappuram	540
	Total	**3064**

C. Sample-size Determination

Sample- size calculation is the determination of the adequate number of data which is necessary to formulate a right decision on particular research. Normally, it is

believed that more data will lead to more accurate results with fewer errors. However this doesn't imply that more data is always better in sample size calculation. So the decision on sample size determined after conducting power analysis (Mac Callum et.al., 1996)**.** Based on the information obtained from the pilot study. Power is defined as 1-pr {type II error}. While considering the test, there are two types of error occurring and we fix only type I error at 5% level (usually called p value) which results in increase of the type II error, which also has to be controlled. One method to do so is the increase in sample size. But the sample is too costly, time consuming and in certain cases impossible. So, we cannot increase the sample size beyond a limit. All the statistical software provides sample size determination for different statistical tests for the given value of Pr {type I error} and power [1- pr {type II error}]. Accordingly, researcher used the power analysis based on the pilot study with 5per cent level significance (p value) and 90% power using software Sigma-plot 11. The result of the analysis is given in the following table:

Table No. 1.3
Minimum Sample Size

Type of Test	Minimum Sample	Maximum Sample
t test	32	128
ANOVA	34	147
Correlation	49	216
So required sample size	**216**	

Table No. 1.4
Master Sample Plan for selecting SPV customers

Sample Required	216
Technique	Multi Stage Random Sampling
Stage:1	Kerala divided into 3 Regions
Stage:2	District selected from regions based on high installation
Stage:3	Random sampling for selecting respondents from district wise list

For selecting customers, Multi Stage Random Sampling Technique was adopted. In the first stage, the researcher divided the whole state into two groups. In the second stage, the researcher selected four districts randomly from high

installation districts. Thiruvananthapuram, Ernakulam, Thrissur, Malappuram based on higher number of SPV installations.

Table No. 1.5
Classification of districts as per RTPV Installations

High	Low
Thiruvananthapuram	Pathanamthitta
Kollam	Alappuzha
Kottayam	Idukki
Ernakulam	Palakkad
Thrissur	Wayanad
Malappuram	Kannur
Kozhikode	Kasargode

1.11.5 Company / Dealer Selection

For studying the problems in the solar energy market in Kerala, companies and dealers were interviewed. It was very difficult to find out and collect the actual number of solar companies and dealers at the time of starting research due to the very fragmented and complicated nature of SPV market in Kerala. There was no authentic list existing in the state which includes all solar energy dealers and companies who played in Kerala SPV market. As SPV is the most promoted solar energy product all over the world, the Indian Ministry empanelled 275 companies which are authorized to install the solar rooftop power plant. When the researcher started the study, there were only seven Kerala based companies included in the MNRE list (In 2013-14). The researcher also came to know about Kerala Renewable Energy Entrepreneurs Association (KREEPA), which is an association of solar energy dealers situated in Ernakulam. In the case of selecting companies, the researcher held discussions with the officials of ANERT and some of the established dealers and travelled extensively throughout the sample districts and consult the KREEPA and it was understood that there were mainly two categories:

1. MNRE channel partner (Government intervened market)
2. Non channel partner (Private market)

Furthermore, many NGOs, PSUs and many private dealers are engaged in SPV marketing. However in 2014-15, MNRE empanelment list already contained

500 companies from India which include 30 companies from Kerala. For studying the marketing problems, it is essential to select companies who have experience in large installations both in domestic and nondomestic sectors. To get a better representation, companies which have done domestic and nondomestic installations in Kerala were select from MNRE list. As this includes newly and not much established companies, the researcher has to filter some of the companies on the basis of two criteria:-

1) KW installed in Kerala (above 50kw installations)
2) ICRA Rating-Average 3C and above

For getting Non-Kerala based companies who had done installations in Kerala, it was decided to consider the list of companies approved for implementation of 10,000 rooftop program by ANERT. The Agency already empanelled almost 25 companies for running 10000 solar energy rooftop programme from MNRE channel partners and then reduced it to 14. So based on discussions with the officials and experts of ANERT, it was decided to find out non-Kerala based companies who had done large installations in Kerala. Thus the researcher formed two groups. This will form the sampling framework for dealers.

1. Kerala based companies
2. Non-Kerala based companies.

Interview has been held directly with Managing Directors of Kerala based companies and with dealers of selected Non-Kerala based companies.

Table No. 1.6

Kerala based companies list included in MNRE Empanelment for Off-Grid and Decentralized Solar Applications Programme 2015.

Sl.No	Company Name	Rating	District
1	M/s Semilon Technologies Pvt	3D	Thiruvananthapuram
2	M/s Sun Energy Solar Solutions	3D	Kannur
3	M/s Greenroof Solar Pvt. Ltd	3C	Ernakulam
4	M/s KC Kopar Energy Solutions Pvt. Ltd	2C	Ernakulam
5	M/s Alternate Energy Corporation	3C	Ernakulam
6	M/s Megabyte technologies	2C	Thiruvananthapuram
7	M/s Ecomate Energy solutions	3C	Ernakulam
8	M/s KELTRON	1C	Thiruvananthapuram

9	M/s Kraftwork Solar Pvt. Ltd	3C	Ernakulam
10	M/s Furbo Security Solutions Pvt. Ltd	3D	Ernakulam
11	M/s Barontech	4C	Ernakulam
12	M/s Soura Natural Energy Solutions India Pvt. Ltd	3D	Thrissur
13	M/sAICA Engineering India Pvt. Ltd	3B	Kottayam
14	M/s VSRN Solar Power	3B	Thiruvananthapuram
15	M/s Solgen Energy Pvt. Ltd	3C	Thrissur
16	M/s Shobitha Electronics Pvt. Ltd	3B	Thiruvananthapuram
17	M/s Morgan Technologies	3D	Thiruvananthapuram
18	M/s NestroMarkrting	3C	Malapuram
19	M/s Reeco Energy India Pvt. Ltd	3B	Idukki
20	M/s Hykon India Pvt. Ltd	2C	Thrissur
21	M/s V-Gaurd Industries	1A	Ernakulam
22	M/s Nature 2 Nature Eco systems Pvt. Ltd	3B	Ernakulam
23	M/s E2 Solar	3B	Ernakulam
24	M/s Moopens Energy Solutions Pvt. Ltd.	3C	Ernakulam
25	M/s VVK Solar & wind Power Pvt. Ltd.	4C	Thiruvananthapuram
26	M/s Wattsun Energy India Pvt. Ltd.	3D	Thiruvananthapuram
27	M/s Kavone Technology Pvt. Ltd.	3B	Ernakulam
28	M/s Team Sustain	2B	Ernakulam
29	M/s IGA Tech Industrial Electronics Pvt. Ltd	3D	Ernakulam
30	M/s Amini Solar Pvt. Ltd	2B	Thiruvananthapuram

Table No. 1.7

List of companies approved for implementation of 10,000 rooftop program by ANERT

Sl.No.	Empanelment No.	Name of the Company
1	EA/2012/01	Millenium Synergy Pvt. Ltd
2	EA/2012/02	Power One Micro Systems
3	EA/2012/03	Gensol Consultants Pvt. Ltd
4	EA/2012/04	Adithya Solar Energy Systems
5	EA/2012/05	Solar integration India Pvt. Ltd
6	EA/2012/06	Su-Kam Power Systems Pvt. Ltd
7	EA/2012/07	Tata Power Solar Systems
8	EA/2012/08	Surana Ventures Pvt. Ltd
9	EA/2012/09	UM Green lighting Pvt. Ltd
10	EA/2012/10	Ammini Solar Pvt. Ltd
11	EA/2012/11	Waaree Energies Pvt. Ltd
12	EA/2012/12	Luminous Power Technologies Pvt. Ltd
13	EA/2012/13	Eversun Energy Pvt. Ltd
14	EA/2012/14	Chemtrols Solar Pvt. Ltd
15	EA/2012/15	Lanco Solar Pvt. Ltd

16	EA/2012/16	Radiant Solar Energy Pvt. Ltd
17	EA/2012/18	Agni Power and Electronics
18	EA/2012/20	Autonic Energy Systems Pvt. Ltd
19	EA/2012/21	Pace Power Systems Pvt. Ltd
20	EA/2012/22	Thermax Ltd
21	EA/2012/23	Moser Baer Solar Ltd
22	EA/2012/24	Emmvee Photovoltaic Power Ltd
23	EA/2012/25	Bosch Limited

Table No. 1.8

List of selected Kerala based MNRE Empanelled companies for Off-Grid SPV programme -2015

	Empanelled Companies in Kerala	**Rating**	**District**
1	M/s Keltron	1C	Thiruvananthapuram
2	Team Sustain	2B	Ernakulam
3	V-Guard	1A	Ernakulam
4	Ammini	2B	Thiruvananthapuram
5	M/s K C Kopar	2C	Ernakulam
6	Megabyte Technologies	2C	Thiruvananthapuram
7	Hykon	2C	Thrissur
8	VSRN	3B	Thiruvananthapuram
9	Shobitha	3B	Thiruvananthapuram
10	AICA	3B	Kottayam
11	N2N	3B	Ernakulam
12	E2 Solar	3B	Ernakulam
13	Reeco	3B	Idukki
14	Kavone Technology	3B	Ernakulam
15	M/s Moopens	3C	Ernakulam
16	M/s Alternate Energy Corporation	3C	Ernakulam
17	M/s Solgen	3C	Thrissur
18	M/s Green roof	3C	Ernakulam
19	M/s Kraftwork	3C	Ernakulam
20	M/s Ecomate Energy Solutions	3C	Ernakulam
21	Nestro Marketing	3C	Malappuram

Table No. 1.9

ANERT selected agencies for implementation of 10000 rooftop programme in Kerala

	Non Kerala Based Empanelled Companies	**Rating**	**Installations**
1	TATA Power Solar Systems	1A	3452
2	SU-Kam Power Systems	1A	306
3	Millenium Synergy Private Limited	2D	289
4	Power One Micro System	2B	222
5	Solar Integration Private Limited	2	106

6	Chemtrols Solar Private Limited	2B	77
7	Radiant Solar Pvt.Ltd.	3B	106
8	Moser Bear Solar Ltd	2C	191
9	EMVEE Photovoltaic Power Ltd	1A	89
10	Bosch Ltd	1A	116

ANERT already empanelled almost 23 companies for running 10000 solar energy rooftop programme from MNRE channel partners and then reduced it to 15 because some of the companies are delisted by ANERT due to noncompliance with already specified standards and specifications. So, based on discussions with the officials and experts of ANERT, the researcher found out the Non-Kerala based companies who had done large installations in Kerala and selected 10 companies from ANERT list. It is decided to interview one dealer for each selected company through random sampling

Therefore total number of selected dealers/ Companies = **21+10=31**

Even though the Kerala based companies are registered as companies, they are taken as dealers for the purpose of research, because they also act as dealers for another companies**.**

1.11.6 Tools for data collection

Self administered questionnaire were used to collect primary data from the respondents to know their awareness, influencing factors, and satisfaction towards adoption.

Design of Research Instrument

The research instrument was developed using extensive research materials from literature and discussions from solar energy experts, as it was the first attempt to study SPV adoption in Kerala. One structured questionnaire was prepared for collection of primary data in order to measure the awareness, the influencing factors for adoption of SPV and satisfaction of consumers.

For conducting interview with the SPV customers, 160 variables were developed to study the awareness, influencing factors, and satisfaction of domestic consumers towards Rooftop Photovoltaic (RTPV). The respondents were asked to

indicate their level of agreement or disagreement with each statement using a five-point scale Likert-type scale: 5=Strongly agree, 4=Agree, 3=Neither agree nor disagree, 2=Disagree, 1=Strongly disagree. For measuring the first latent variable satisfaction (SAT) measured with the help of 4Ps namely Product Oriented Aspects (POA)-6 items) Price (2 items), Communication (COMN-4 items) and Convenience (CON-3 items). Moreover Ease of Use (EOU) and Service Oriented Aspects (SOA) constructs were also used with 4 items and 9 items respectively. For measuring the second latent research variable, Continued Adoption Intention (CAI-2 items), and seven constructs as pre adoption factors namely Awareness (AWA-20 items), Economic Factors (10 items) Environmental Attitude/Relative Advantage (11 items), Buyer Social Responsibility (11items), Perceived Usefulness (6 items), Attitude Towards Government Initiatives (7 items), Subjective Norms (5 items) were formed to test their effect on CAI. The Third research variable Repeat Purchase Behaviour / Further Adoption measured (3 items) and finally the fourth research variable Positive Word of Mouth (PWOM)/Recommendation (RMN -3 item) was created as outcome variables. The first session deals with the psychographic analysis which includes 11 sub-items to check the awareness of different solar energy technological products, selecting the best media for creating awareness, choosing suppliers and other descriptive details.

The second session deals with 20 items which are to measure the awareness of a SPV customer regarding various aspects, such as basic function details, new government programme related to RTPV. Question No:13 includes 69 variables which measure the influencing factors for the system adoption and 3 variables relating to RPB. Question No:14 involves 30 variables to measure the satisfaction of this particular product. Further, 6 specific attributes indicated related to customer satisfaction and all these variables measured on five point scales ranging from “highly dissatisfied to highly satisfied”. Each of these six variables is hypothesized to affect overall satisfaction which in turn influences the outcome variables CAI, RPB and PWOM. Here question No: 15 involves 2 variables for measuring CAI and question No: 16 involves 3 variables for measuring PWOM.

Table No. 1.10

Design of the Customer questionnaire

Variable	Decision -1	Decision -2	Decision-3	Codes
Post Adoption Factors-SAT				
PRO PRI COMN CON PEU SOA	Non-Graphical	Balanced	5point	5-highly satisfied 4-satisfied 3-neither satisfied nor dissatisfied 2-dissatisfied 1-highly dissatisfied
CAI	Non-Graphical	Balanced	5point	5-highly satisfied 4-satisfied 3-neither satisfied nor dissatisfied 2-dissatisfied 1-highly dissatisfied
Antecedents to mediator (Pre-Adoption Factors)				
AWA EF EA/RA BSR SN PU ATGI	Non-Graphical	Balanced	5point	5-Highly Agree 4-Agree 3-Neither Agree Nor Disagree 2-Disagree 1-Highly Disagree
Outcome variables				
RPB PWOM	Non-Graphical	Balanced	5point	5-Highly Agree 4-Agree 3-Neither Agree Nor Disagree 2-Disagree 1-Highly Disagree

Table No. 1.11

Variables for analyzing customers Questionnaire

Sl.No:	Purpose	No of variables	Scale
1	To study the awareness of solar energy products	11	Scale
2	Using equipment	2	Nominal
3	Years of use	2	Nominal
4	Installation		Nominal
5	Inverter use before SPV installation	2	Nominal

1	To study the awareness of solar energy products	11	Scale
2	Using equipment	2	Nominal
3	Years of use	2	Nominal
4	Installation		Nominal
5	Inverter use before SPV installation	2	Nominal
6	Media for awareness	7	Scale
7	SPV details	10	Nominal
8	To know preference for on-grid and off-grid solar	2	Scale
9	Electricity consumption details	6	Nominal
10	Cost details	2	Nominal
11	Sources of funds	2	Nominal
12	Influencing factors for selecting COM C the company	12	Scale
13	Pre Adoption Factors		
	RTPV Awareness	20	Scale
	Economic factors	10	Scale
	Government initiatives	7	Scale
	Utility factors	6	Scale
	Environmental sustainability factors	11	Scale
	Buyer social responsibility factors	11	Scale
	Social influences	5	Scale
	Post Adoption Factors		
14	Satisfaction	30	Scale
	1)Products Oriented Aspects	6	Scale
	2)Price Oriented Aspects	2	Scale
	3)Communication	4	Scale
	4)Convenience/Distribution	3	Scale
	5)Ease of Use	4	Scale
	6)Service Oriented Aspects	9	Scale
	Outcome Variables		
15	CAI	2	Scale
16	RPB	3	Scale
17	PWOM	3	Scale
18	Socio-Demographic Variables	6	Scale

The second schedule was intended to collect data from the SPV dealers or companies which were designed based on previous literature reviews and after adequate consultation and discussions with the experts in the field of solar energy. This related to overall (especially non technical barriers) existing all over the world which is identified from literature reviews. And the researcher wants to confirm whether these barriers exist in Kerala also. This study was conducted based on the primary data which was collected through a structured interview schedule. The research instrument was developed using extensive research materials from foreign literature and discussions from solar energy experts as it was the first attempt to study SPV in Kerala. Initially 80 items were picked up to understand the dealers perceptions regarding barriers to RTPV penetration and then they were reduced to 62 questions. Question number 1-12 deals with general information which is nominal, from 12 to 45 related to assessing barriers which used 5 point scale and 46 to 62 questions include open ended questions also related to their activities, operations, benefits and satisfaction which are also scaled questions.

Table No. 1.12

Design and Variables for dealer questionnaire

Sl. No:	Purpose	No: of variables	Scale
1	Location	2	Nominal
2	Year	4	Nominal
3	Nature	2	Nominal
4	Type	5	Nominal
5	Type of solar energy	3	Nominal
6	SPV type	3	Nominal
7	Type of technology	3	Nominal
8	Cumulative SPV installations	4	Nominal
9	Area of operation	4	Nominal
10	Promotional efforts	6	Nominal
11	Support from bank	2	Nominal
12	Marketing Barriers	34	Scale
13	Support from Government	3	Nominal
14	AMC	2	Nominal
15	Number of visits to customers	4	Nominal
16	Suggestion to Government	5	Nominal
17	Strengths of company	8	Ordinal

18	Percentage of Indian made components and labour	3	Nominal
19	Customer Satisfaction	5	Scale
20	Consideration of rural consumers	2	Nominal
21	Financial support to customers	2	Nominal
22	Incentives received from Government	4	Nominal
23	Beneficial scheme of government for solar energy promotion	3	Nominal
24	Dealers satisfaction with 10000 solar rooftop programme	5	Scale

1.12 Pilot study

A pilot study of 50 SPV customers was conducted for testing the appropriateness of the research questions and methods adopted**.** A pilot study with 50 respondents was conducted in order to ensure different types validity and reliability of the questionnaire**.** A personally administered questionnaire method was employed for the survey because facility to ask complex questions, classification of questions, speed, anonymity and quality control etc are make easy and incorporated changes in the preliminary interview schedule. Informant was generally head of the family. In their absence, senior member or who is responsible for the SPV adoption decision was selected. A reliability test was done on the responses pertaining to awareness, influencing factors, satisfaction, PWOM and RI based on statements on a five point scale

1.13 Reliability Analysis

The researcher checked the reliability of the questionnaire by using Croanbach alpha reliability co-efficient. It is necessary for any further validation analysis. Reliability refers to degree of dependability or consistency of a scale. An alpha value of 0.70 or above is considered to be the criterion for demonstrating strong internal consistency. Alpha value of 0.60 or above is considered to be significant (Croanbach and Meehl, 1955). The following table gives the initial Cronbach's alpha for each of the construct considered. Result shows that most of the constructs have reliability greater than 0.7. So we proceed for further analysis.

1.14 Measures of Validation

A Validity Check:

Validity is the most critical evaluation and indicates the degree to which an instrument measures, what is believed to measure (Koeske, Kirk, Koeske, Rauktis, 1994)**.** Content validity, criterion validity, conformity of the variables selected checked by conducting a three round focus groups of co-researchers, subject matter experts, and with original samples.

A .1 Content and face validity

It is a non- statistical type of validity and it checks the adequate coverage of the topic. The researcher consulted various experts in this particular field and academic professionals for checking this validity and ensured that the questionnaire so prepared for the evaluation of the determinants of purchase behavior and their satisfaction is measured with sufficient content validity. Face validity of the questionnaire also judged by the experts.

A.2 Construct Validity

Construct validity can be assessed by two types of criteria: convergent and discriminating validity.

A.2.1 Convergent Validity

It refers to the degree to which a measure is correlated with other measures that are theoretically predicted and it is considered as one of the approaches to the construct validity. This involves empirical and theoretical support for the interpretation of the construct (Baggozzi et.al., 1991). Constructs are theoretical and unobserved. Each scale in the item is treated as different approach to measure the construct. Accordingly, by using CFA, each item in the scale is checked with the help of CFA factor loading. CFA factor loading which is above 0.50 is an indication of strong convergent validity. AVE measure which is above 0.50 is also used to check convergent validity. It has been observed that CR values of each construct which are above 0.50 also confirm convergent validity.

A.2.2 Discriminant Validity

The constructs used in the model revealed discriminate validity as a high AVE values greater than the pair wise correlations. So it is confirmed that scale measures used to measure different dimensions are divergent**.**

B. Normality

It is very essential to test the normality of the data before conducting any statistical analysis as the statistical procedures and test differ for normal data and non normal data. In other words, we use parametric tests procedures for normal and distribution free methods for non normal data. To test normality, we use Kolmogorov Smirnov test under which we test the hypothesis. If p value is less than 0.05, reject the normality assumption. If P value is greater than 0.05, the data is normal. Accordingly before conducting SEM, first we conduct the K-S test and the following table gives the result of the K-S test. The test indicates that the data is normal**.**

Table No. 1.13

K-S test for Normality

Variable	N	Mean	Std. Deviation	Kolmogorov-Smirnov Z	p value
Awareness of solar energy products	315	28.31	8.67	1.272	0.079
Media for getting awareness about solar energy products	315	17.30	4.39	1.529	0.064
Influencing factors for selecting company	315	34.29	7.69	0.947	0.331
Awareness oriented aspects	315	41.14	12.83	0.718	0.237
Economic factors	315	26.14	5.01	1.269	0.080
Government initiatives	315	25.82	4.77	1.463	0.072
Perceived Usefulness	315	21.39	3.43	1.592	0.056
Environmental Attitude	315	48.50	6.02	1.467	0.072
BSR	315	48.31	5.98	1.438	0.076
Subjective Norms	315	8.92	3.78	1.076	0.141
Repurchase Intention	315	11.95	2.46	1.256	0.105
Products oriented aspects	315	18.97	3.88	1.002	0.159

Price oriented aspects	315	3.86	0.87	1.548	0.061
Product usage aspects	315	5.62	2.11	1.115	0.133
Service oriented aspects	315	20.40	4.11	1.224	0.100
Communication related aspects	315	16.10	4.19	1.328	0.092
Distribution related aspects	315	13.85	3.50	1.304	0.097

1.15 Data collection procedure

Research questions were addressed using data from 315 customers who own RTPV through '10000 solar rooftop power plant programme'. The key informant was first contacted over telephone, requesting for their participation in the survey. Some respondents want a direct face to face visit and remaining agreed to mail responses to the questionnaire. Therefore, in order to obtain the responses, mixed strategies /varieties of data collection methods were employed by the researcher. After getting the consent of the respondent, they were mailed a package constituting a covering letter which briefly speak about the basic information on the importance, need and confidentiality etc which are ensured. Moreover, a copy of qualified certificates of researcher are also attached as it was felt urgent to inculcate confidence among the respondents because there were issues related to solar was at the top when the time of survey. A questionnaire and a self addressed pre- paid envelope were also included in the package. If responses were not received within two weeks then a follow-up call was made by the researcher. A self-administered questionnaire was distributed among the selected respondents through direct visit or mail. These two methods were employed by the researcher to suit the convenience of the respondents during initial phone call requesting for participation. Therefore, this research used data from 315 customers who own SPV through '10000 solar rooftop power plant programme'.

1.16 Tools for Analysis

The statistical analysis comprises three stages. First stage examined the descriptive statistics and second session involves the empirical validation of proposed research model. Third stage involves additional findings which involve the socio demographic differences and finally the barriers faced by the RTPV dealers. SPSS version 17 and AMOS–were used to analyze data.

1 Descriptive statistics: Mean, Standard Deviation, Range (QD)

2 One-Sample t Test - Used to examine the mean difference between the sample and the known value of the population.

3 Weighted Average Technique- In the case of ranking questions in dealer survey. The weighted mean is calculated for each category and ranks are assigned on the basis of the values of the weighted mean.

4 Independent sample t test - is used to compare means of two independent groups.

5 One Way ANOVA to find out the significance difference between socio demographic factors with the pre and post adoption factors. Analysis of variance is used to test the hypothesis that several means are equal. Multiple comparison test-Tukey USD were used to find out the groups having significant difference (to know which mean differ) reveled through One Way ANOVA testing.

6 Exploratory Factor Analysis (EFA) used for identifying the unidimensionality of factors involved in the model and grouping the barriers faced by the dealers in RTPV market.

7 Confirmatory Factor Analysis (CFA) were used to test the overall model fitness with the observed data and to reconfirm the dimensional structure through checking of fit indices.

8 Structural Equation Modeling (SEM) was used to test the hypothesis which explains the casual paths among the latent variables.

1.17 Limitations

1. Only the districts which have higher number of SPV installations are selected for the study.
2. A comprehensive survey for dealers by taking large size of respondents was not possible during the survey time.

1.18 Outline of Chapters

The report of the work has been presented in 8 chapters.

Chapter 1- The first chapter consists of introduction, significance of the study, research problem, scope, objectives, hypothesis, methodological design, conceptual model, limitations and chapterization of the study.

Chapter 2- Second chapter constitutes the review of existing literature. It is divided into five sections namely literature related to green energy, solar energy, antecedents/pre adoption of APB for RTPV, post-adoption behavior for RTPV including antecedents (six dimensions contributing SAT) and consequences of satisfaction (repurchase and recommendation).

Chapter 3- An Overview of Solar Energy Scenario in Kerala. This chapter is divided into four sections which consist of green energy scenario, solar energy scenario of global, national and Kerala.

Chapter 4- Theoretical Background for Pre and Post adoption behavior of Innovative Renewable Energy Product.

Chapter 5- Modeling Antecedents and Consequences of RTPV Adoption Behaviour - A Discussion. This chapter presents the research model analysis. This chapter is divided into two sections. Section A deals with descriptive statistics related to demographic profile of the users B deals with the EFA analysis of constructs used in the model. Section C deals with CFA of the constructs and D includes the final research model analysis using SEM.

Chapter 6- Buying Behavior and Barriers towards RTPV Market- A consumer and Dealer Perspectives: Include some additional findings from primary data analysis of consumers. Section A contains the results of analysis of demographic wise comparison with pre and post adoption factors and their perception regarding RTPV market. Section B presents the analysis of the barriers faced by RTPV dealers in Kerala market.

Chapter 7- It includes summary, findings, conclusions and implications. Seventh and last chapter presents the major findings of the study, the conclusion, implications and scope for further research.

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CHAPTER 2

REVIEW OF LITERATURE

CHAPTER 2

REVIEW OF LITERATURE

In order to obtain the directions for the current research work, the researcher tried to briefly review the literature related to different concepts of the study and identified the gap and finally conclude with a conceptual model and proposed hypotheses to be empirically tested. Furthermore literature review helps to generate insight and evidences of relationship among variables. This chapter was arranged in an order which contains at least five studies for each construct involved in the model and a separate section for integration of TRA, TPB, TAM, and IDT theories using SEM. The studies relating to research area are classified into the following sections:

2.1 Green energy

2.2 Solar energy

2.3 Pre-Adoption factors: includes literature for each constructs included in Actual Purchase Behaviour (APB) of RTPV namely, Awareness (AWA), Economic Factors (EF), Attitude towards Government Initiatives (ATGI), Environmental Atttitude /Relative Advantage (EA/RA), Buyer Social Responsibility (BSR), Perceived Usefulness (PU), and Subjective Norms (SN).

2.4 Post-Adoption Factors: Includes literature for six dimensions for Satisfaction i.e, Four Ps, viz. Product oriented Aspects(POA), Price, Communication (COMN), and Convenience (CON) and two other relevant constructs namely, Ease of Use (EOU), and Service oriented Aspects (SOA). Further, outcome variables Continued Adoption (CAI), Repeated Purchase Behavior (RPB), Positive Word of Mouth (PWOM).

2.5 Barriers in Solar Energy Market

2.6 Conclusion

2.1 Green energy

Kharul,R. (2008) stated that about 61 per cent of total emissions in India are contributed by the energy production centers. He observes that real and major solutions to emission reduction would come from an intended conversion to a low carbon economy by deploying renewable energy. He asserts that India could generate more than 50 per cent of its electrical needs by 2032 through Renewable Energy

Technologies (RETs). This would reduce our import dependence on fossil fuels to a larger extent and it depends on the development of solar energy technologies and reduction of costs.

National Renewable Energy Laboratory (NREL) and National Marketing Institute (NMI)-2011 conducted an exploratory investigation about consumer awareness, concern, perceived benefits, knowledge of purchase options and usage of RE and also regional comparisons and trends by using LOHAS (Lifestyle of Health and Sustainability) consumer trends database from Natural Marketing Institute (NMI) by conducting an online survey of 4000 US adults population. The result of the survey indicated that a major share of consumers pay attention to the use of renewable energy, even though they are sensitive to price. It was also found that there is relatively low consumer awareness about renewable energy purchase as an alternative. Only one in six consumers is conscious about the green power options provided by the electric power providers. Similarly, they also found that there are a small number of differences in consumer attitudes between regions and stated that consumers in the western region are more aware of RE and suggested that there is further opportunity for market growth in this sector if consumer awareness can be achieved.

2.2 Solar Energy

Quasching,V.(2006) pinpointed that our energy supply needs could totally be covered by renewable energy sources within a few decades. He noted that energy use has always had a clear impact on the environment and he also pointed out that a solar energy system often compares favorably in terms of cost and supply reliability photovoltaic is already an economically competitive technology in several niche applications.

A report titled **"Grid parity is key to solar's growth", 2011**, says that solar energy is expected to meet 5 per cent to7 per cent of the power requirement of the country by 2021-22, by relocating 16900 MW of fossil fuel power, and will be able to save 61 million tonnes per annum (MTPA) of coal. The report also mentioned the rising trend of cost of conventional power at the rate of 4 per cent to 5 per cent and the declining trend of the price of solar power at the rate of 5 per cent to7 per cent per annum leading to grid parity by 2017-19.

Bahuleyan K.D. (1992) pointed out that energy demand in the state is on an increasing trend and present energy scenario of Kerala is witnessing imbalances between demand and supply. Energy scarcity problems particularly affected the poor people which lead to low standard of living and it creates social tensions. He presents the solar potential in the state to overcome acute energy crisis, and also mentioned that 10000 MU of electrical energy can be produced by using house and factory rooftops as collectors. He also reported the negative consequences from the non - adoption of RE sources.

Robert F Lee. (2001) states that PV is turning to be the cost effective, most reliable energy option and found applications in isolated locations, such as telecommunications, water pumping, ,signaling, housing and a variety of consumer products. Globally, there are around 300-400 million unelectrified houses that are not likely to connect with grid power in a predictable future. He also noted that there are 75 million unelectrified households in India. He also mentioned that India became one of the largest PV markets representing 12 per cent of world PV sales in 1996 with 11 MW PV sales.

Millinger,M., & Marilind,T. (2011) conducted a field survey in eleven villages of Chhattisgarh, India among 168 respondents to identify the vital factors regarding organization and design of Solar Photovoltaic (SPV) system and Solar Water System (SWS). The study also tried to review the success factors regarding rural electrification by Chhattisgarh State Renewable Energy Development Agency (CREDA), the nodal agency for solar energy implementation in the state and also reported that access to energy in general and electricity in particular has the potential to contribute to benefits in health, education, income and environment. The study revealed that technical longevity and organizational functionality are matters that affect these goals. Technical problems like quality of installation affecting the differences in output are found to create social conflicts. The study also points out that failed inverters are a cause for larger maintenance cost. They emphasized the correlation with Gross Domestic Product and Human Development Index are strong. They indicated that 1.4 billion/one fifth of the world's population live without access to electricity, of which 400 million people live in India. They mentioned that India is an area with one of the best solar resources in the world, with solar irradiation ranging between 1,900 and 2,200 KWH/$_{m2.}$

Buragohwn,T. (2012) made an attempt to assess the functionality of solar PV system and social impact of the government solar PV programme on the beneficiaries. She spoke about the impact of RE in changing the socio economic status of women. A household survey was conducted among 10000 households from 371 villages spread over 41 districts by National Council for Applied Economic Research (NCAER). The survey conducted in six states, viz, Assam, Meghalaya, Jharkhand, Odisha, Madya Pradesh and Chattisgarh by using two structured questionnaires, one at the village level and one at the household level. FDS (Focus Group Discussion) was also organized to study the social impact on beneficiaries. The result showed that there is variation in the functionality in different States according to season. More importantly, the study revealed a significant improvement in children's education, standard of living after installation of solar lighting. It is a notable finding that there is a decline in crime rates due to availability of solar street lights, which will be more beneficial to women and children.

Lemaire,X. (2012) observed that the reliability of solar energy system is much higher than diesel generator due to the lack of dependence on the supply of mechanical parts. The author states that some elements of the institutional frame work are needed for the large scale diffusion of solar home systems. He pointed out the need for a special financing mechanism and private-public partnership to support dissemination. The author tries to compare the conditions for implementation of micro credit schemes and fee for service schemes. He explains that the choice between the two main mechanisms depends on existence of a strong network of micro finance institutions, broader socio cultural context, and political choices from public decision makers.

2.3 Pre-Adoption Factors

Bhandari, K.A., & Jana, C. (2010) conducted a study on domestic preferences for SPV stand-alone and mini grid system in the coastal village of Indian Sunderban. The study used direct interview through a structured questionnaire of household heads to collect data on the impact of household characteristics on preference for electrical energy. They tried to make a comparative evaluation of Solar Photovoltaic Home Lighting System (SPV HLS) and mini grid and the study indicated that solar photovoltaic based system has been extensively accepted technology for rural electrification in developing countries. They mentioned that SPV HLS is popular

among rural households, while SPV mini-grid supply is promoted for rural electrification schemes. They noticed dissimilarity in the behaviour pattern of household characteristics. The different household characteristics, such as monthly income of households, size of the house, occupational status of the household head, number of rooms and type of house significantly influence the decision on SPV stand-alone home lighting system and household's income. Monthly expenditure on kerosene is found to be significant for SPV mini grid supply.

K.E.Raghunathan. (2006) states that solar energy is versatile and has been growing at a rate of 60 per cent all over the world since last four years. Its applications range from powering a calculator to powering a nation. Moreover he indicated that it is the only decentralized form of energy and he discussed different phases of solar market development and mentioned factors that would push up solar sales. Good product quality, alternative price option, availability of products in all parts of the country, mass advertisement campaign, good service network, a viable and effective financing option, committed support and motivations from banks and lending institutions and awareness regarding the scheme, ensuring sales direct associates are the factors for acceleration of solar energy products penetration.

KudakwasheNdhluka. (2012) analyses the Namibian policy perspectives on solar energy and clarified the importance of renewable energy and energy efficiency in Namibia's socio-economic development. He observed that Namibia has adopted a market approach in solar electrification in which the government helped the interested rural households for adoption of photovoltaic solar home system through launching solar revolving fund. He suggested that education in RE and rational use of energy be included in the curricula of school, universities, polytechnics, vocational training centers and other institutions of instruction.

B.Bharghava (1995) investigated the implementation strategies and new initiatives for the solar energy products and stressed the importance of removing the barriers to private sector participation. The research recognized that multimedia awareness as a powerful strategy. Business promotion campaigns are critical for market development. He emphasized that even if the initial cost is high, it turns out to be cost effective on a life cycle cost basis compared to petrol and kerosene cost. He also points out that, with the increase in production volume and improvements in PV system design,

reliability and life expectancy, solar PV will became more economically attractive for a large number of decentralized applications.

Byrne, J.,& Lado. (2011) highlighted the shortage of poly silicon supply which is the raw material for solar cells manufacturing and it is one of the chief contributor to the high cost of solar energy. They made an attempt to review the policies in key countries and found that state policies are the important drivers for industrial boom. The study discussed national and local government PV supporting programmes that include tax credits and exemption, preferential interest rates, loan programs and direct incentive which consist of performance based incentive and capital subsidies, building code mandates, feed in tariffs, RPOs, voluntary green power programs, net metering, interconnection standards, and demonstration or pilot projects.

Wahi, R. R. H., & Ahsan, N. U. (2012) carried out a study to evaluate the financial viability and to find out social and technical aspects of SHS system in selected villages of Ghaziapur district. They argued that installation of solar home system should provide a sustainable way to power households by supplying clean, high quality, reliable, sustainable energy. They have an impact on the rural people by improving direct and indirect socio-economic benefits, like better amenities in education, recreation and communication, and promotion of small commercial activities. Furthermore it would improve the overall standard of living of rural people. The authors also tried to conduct a cost benefit analysis of the SHS and kerosene lamps which were used by the villagers and found out the long term benefits of SHS. However, the study also pointed out that the lack of public awareness, acceptance of the functional ability of SHS and difficulty to convince the rural population about the long term benefits of the solar system. They stressed the need for proper financial arrangement for the rural people in order to boost the market.

Rai, V., & Mc Andrews, K. (2012, May) tried to examine the motivating factors of PV adoption, the socio demographics of PV adopters, their decision making process and the impact of PV adoption on the adopters awareness of electricity use in Texas. This study gives more focus to post installation consumer experience to know whether the information received by the respondents in their pre-adoption period was true. Post- adoption experience must meet the pre adoption expectation in order to avoid post- adoption disconfirmation. This study uses a survey-based research design which

collected data from central and northern Texas. They conducted an online survey and collected 365 responses. The researcher summarized them and found that PV adopters in Texas belong to highly educated class with high incomes. The study revealed that interest in energy and desire to reduce environmental degradation are the important motivators for PV adoption. They also stated that simple metrics like payback period has been used by a majority of adopters for evaluating the financial benefits of PV. The researcher also pointed out that the PV adopters are highly satisfied with the decision to adopt PVs and a significant portion of PV adopters perceives that their electricity consumption is lower than that of pre-installation period.

Spicer, S. E., & Sun, Y. (2015) conducted a study among Chinese students to investigate the perception about solar PV adoption system. Convenience sampling method was used for selecting the samples. Accordingly, 275 valid responses were collected from two universities through questionnaire method. They elucidated that the awareness about PV adoption is low among students when compared to other solar energy applications. The research also reveals that only emphasis on pollution can lead this generation to opt clean energy. The study also brings out the importance of inclusion of sustainability in curricula, promotional programmes, effective communication among government, potential buyers and PV industry. However, a majority of the students had the belief that PV has a higher potential in future market.

Awan, U., & AamerRaza, M. (2010) made an attempt to study the factors affecting consumers while taking decision on electricity providing company and the importance of environmental issues in consumer decision making process. The study used quantitative research method and convenience sampling. Data was collected through self administered questionnaire. They presented the background information of energy market, concept of green marketing, social responsibility, green energy and consumer behaviour. Lower price, quality of service and green making efforts of the company are identified as the influencing factors while selecting green energy and developing the attitude towards green energy. Results show that consumers are willing to pay more for sustainability of environment, but they always worried about high price for green energy when compared to the conventional energy. The study supported the use of advertisement and positioning consumers as socially responsible for making the consumers aware of it.

Faiers, A., & Neame, C. (2006) investigates householder attitudes towards characteristics of solar systems by using diffusion of innovation theory which states that innovations have five major attributes, viz. relative advantage, compatibility, observability, triability, and complexity. He categorizes the sample into early adopters and early majority and the research highlighted that the early adopters are currently adopting the systems. Change in the attributes of solar energy will increase its relative advantage necessary for early majority to adopt this technology. He suggested a review of the current policies to grant aid to the technology and further improvement of financial advantage.

Anupama S Chavan (2013) tried to analyze and compare the influencing factors in the behaviour pattern while purchasing solar energy products, namely solar water heater, solar inverter, solar LED lights and street lights and identified the buying patterns of these products from the perspective of manufacturers. The researcher conducted a survey among users, non-users (buyers and prospective buyers) and suppliers and came to the conclusion that cost is considered as a significant factor for solar water heater and solar inverter. However, after sales service, product was given least preference. Another finding was that credit and government subsidy is a significant factor for solar water heater especially for individual buyers however social and environmental concerns are not a significant factor for the use of these products. More importantly, utility of solar energy products is considered to be a significant factor for all these selected products.

Lu, I. Y., & Chen, J. Y. investigated the factors for the successful adoption of Innovative Renewable Micro Generation (IRMG) Technology in Taiwan. In their study photovoltaic is taken as innovative green micro generation product. A survey was conducted among 300 people using convenient sampling by distributing questionnaires and employing seven point likert scales. A final valid sample of 226 data was collected and analyzed using SEM to validate the proposed model for customer's acceptance of RE micro generation. The study uses TPB, theory to extend some of the variables which proved to be the antecedents of household customer's acceptance of Green Innovative Micro Generation (GIMG), viz. relative advantage, compatibility, social responses, complexity and financial assessment. Findings of the study indicate that relative advantage affects most the consumer decision to adopt GIMG. The study also revealed that social responsibility comes as the antecedent of

subjective norm for adoption of micro generation. Compatibility and complexity have significant positive effects on attitude of Green Micro Generation (GMG) and Perceived Behaviour Control. Hence, focus must be given to develop less complicated GMG in order to get more acceptances. Financial assessment was found to have a moderating effect because it influences customer decision to adopt GMG by reducing the willingness for higher prices.

Ballestrazzi, R., Mason, M. C., & Nassivera, F. (2011) conducted a study to identify the factors influencing Environmentally Responsible Purchase Behaviour (ERPB) and tried to investigate the relationships existing between the motives relating to aqua cultural products made with the help of renewable technology within the frame work of green marketing. A survey was carried out among 300 respondents in Italy. The authors categorized CM (Clean Motives), GM (Green Motives) and EM (Ethical Motives) as exogenous latent variables and ATPC (Attitude to Purchase Coopfish), PTC (Perceived Trust towards Coopfish), PQC (Perceived Quality of Coopfish) and WTPC (Willingness To Pay Coopfish) as endogenous variable. The SEM results confirmed the formulated theoretical model by revealing that GM and CM have an effect on ATPC which subsequently affects WTPC through both PTC and PQC. The study reported a positive effect of CM (Clean Motives) and GM (Green Motives) on ATPC which is the determinant of WTPC through PTC and PQC.

Hasan, J., Hartoyo, H., Sumarwan, U., & Suharjo, B. (2012) analyzed the factors which influence the desire to buy Environment Friendly Products (EFPs). They tried to create a model with the variables, namely product attribute, personal characteristics and external factors which are considered to be the driving factors for creating interest and desire to buy EFP through AIDA model and empirically tested through SEM in Jakartha provincial area in the context of environment friendly air-condition product. The study used the responses of 403 randomly selected respondents through multi stage random sampling. The study uses constructs namely, 1) ATTRI (Product attributes) consists of relative advantage, compatibility, complexity, trialiability and observability. 2) EXTER (External factors) includes media utilization, change agent promotion, social interaction and environmental policies. 3) PERSON (Personal characteristics) includes personality, life style, environmental knowledge and decision making pattern. 4) AIDA includes awareness, interest, desire and action. Result indicated that EXTER factors had more influence on the desire to buy EFPs when

compared to PERSON and ATTRI. Promotion and social interaction proved to be the main contributors to EXTER and it also confirmed that 'life style' is an excellent predictor among PERSON and awareness was the only significant factor among AIDA model. Desire is affected by interest which is predicted by EXTER. The study also revealed that relative advantage was the statistically significant influencer for perceived attribute of EFP while not having an effect on interest and desire.

Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2005) conducted an experimental study to examine the relative importance of socio demographic variables and psychological variables in the context of household energy use and changes in energy savings by using Theory of Planned Behavior (TPB) and Norm Activation Model (NAM) which are relevant for explaining pro environmental behaviour. They decided to measure the direct and indirect energy use and savings among 314 households by dividing them in to experimental and control group through an online questionnaire method. The study lasted for five months and an intervention was given to the experimental group regarding energy conservation with a target of 5 per cent energy saving. Control group was not exposed to any intervention. During the period, there was a substantial attrition in the case of respondents and final data set of respondents consisting of 189 households who have completed questionnaire before and after measurement. The study used socio- demographic variables, attitude, Perceived Behavioural Control (PBC), Personal Norm (PN), awareness of consequences, and ascription of responsibility are taken as independent variable and energy use (before measurement), energy savings (after measurement) are taken as dependent measures. All the variables from TPB and NAM were measured two times before intervention and after intervention and responses were recorded on a five point scale. Authors are also interested in knowing whether NAM variable could extend the power of TPB in explaining environment related behaviour. By conducting hierarchical regression, results indicate that energy use is influenced by socio demographic variables while energy savings are influenced by psychological variables. For direct energy use, the effect of treatment was significant whereas it's not significant for indirect energy use. When controlled for the effect of intervention, indirect energy savings can be explained by PBC and ascription of responsibility while direct energy savings could hardly be explained by socio demographic and psychological variable.

Zhai, P., & Williams, E. D. (2012) made a study to discover the role of consumer acceptance and model its effects on residential PV adoption through Fuzzy Logic Inference Model which would relate consumer perception variables to their purchasing possibilities. They observed that consumer perception could play a vital role in the adoption of RE technology. He selected perception variables, such as perceived cost, break even time, perceived maintenance requirement and environmental concern and evaluated purchasing probability of residential PV using this quantitative model. After collecting 454 completed responses which consist of 454 non adopters, 21 grid connected solar adopters and 12 off-grid solar adopters. Therefore, in this research, the responses of these 12 respondents were not considered as their purchasing motivations will be different from those off-grid power consumers. The result shows that public has a tendency to highlight the role of cost reduction in encouraging the adoption of residential PV and also revealed the importance of other issues such as maintenance requirement and environmental concern. The study concluded that these perception variables differ significantly between adopters and non adopters.

Keirstead, J. (2007) analyzed the double dividend effect created by PV among UK household's viz. encouraging consumers to more efficient energy use as well as low carbon electricity. The study revealed that micro generation has become a noteworthy addition to UK energy policy debates. It shows that the installation of PV encouraged households to lessen their overall electricity use by about 6 per cent and transfer demand of peak generation times. Therefore it can assume that PV may lead to changes in household energy consumption behaviour. In 20 per cent of existing domestic installations in the UK, it was found that 33per cent of households had installed SHS before adopting PV. 74 per cent of the respondents believed that SPV will take more than 25 years to pay back and this was not a motive in the purchase decision. Another finding was that the information on PV technology depends on respondent's interest in energy and environment issues and a sense of personnel responsibility. He emphasized the importance of metering and monitoring system in SPV installation. He concluded that final purchase decision is closely associated with the values of the respondents and PV is a part of personally motivated, environmentally aware lifestyle. Therefore PV experience from households shows positive and provides confirmation of "double dividend" from PV.

Lokhande, U. M. (2012) conducted a study on the acceptance of solar equipment by people in Satara district, Maharashtra, to measure the attitude of the people towards renewable energy, solar equipment, energy conservation habits of people, and the problems faced by the people with reference to electricity supply and to identify the awareness of different government schemes available for promotion of solar equipment. He concluded that there is a high awareness about solar equipment among households and industrial people. He states that even though prices of solar equipment are high, there is great benefit in terms of saving over a period, that is, 20 to 30 years. He suggests that if continuous efforts with social marketing approach are made, India will be able to overcome energy shortage and he also states that solar energy will be the energy of future.

Hessami, H. Z., & Yousefi, P. (2013) tried to identify and prioritize factors which influence consumer's Green Purchasing Behaviour (GPB) and developed a model. They observe that even though environmental factors would play an important role in Green Purchasing Decision (GPD), there always seems to have a behavioural gap when actual purchase happens. Authors made an attempt to elicit the relevant factors and developed a conceptual model to explain the main components and dimensions that affect GPD. The validity of the model was confirmed through Fuzzy Delphi Technique. Interaction of the factors (interdependences existing between selected indicators of consumers' Green Purchasing Behaviors) was quantitatively examined by DEMATEL method. The statistical population in this study consists of experienced experts in the industry professors in the field of green purchasing, and consumer behavior and a sample of 35 persons were selected through judgment sampling and finally just 15 questionnaires were used for analyzing. Proposed model takes environmental factors which include social influence, government role, social value, emotional value, epistemic value, conditional value, consumer value, functional value. Individual awareness of green products is important in influencing consumer behaviour and persuade them to buy green products. Results revealed that consumer's environmental ideas, environmental factors, awareness of green products and consumer values are the main components influencing the green purchasing behaviour and concluded that the role of environmental factors got a higher priority than other components.

Ansar, N. (2013) evaluated whether socio demographic variables are relevant to the green consumers and also examined the effect of high price, green advertisement, ecological packaging effects on Green Purchase Intention (GPI). The study carried out survey among 384 selected residents of Karachi, Pakistan through convenience sampling. It's a quantitative study which tries to analyze the impact of socio-demographic variable, price, environmental advertising and eco packaging as independent variables on the dependent variable Green Purchase Intention (GPI). The study highlighted that age and education style have a positive relations with eco-literacy. It is noted that socio demographic variables are not significantly related with green purchase intention. Besides, environmental advertisements, price and ecological packaging were found to be positively related with the green purchase intention. It is also implied from the study that age and education are associated with environmental literacy

Sahu, T. (2012) tried to assess the awareness of consumers regarding green products and analyzed the attitude and behaviour of Indian consumers. He identified the obstacles the respondents face, in the way of adopting green life style and the results indicated the positive impact of environmental consciousness on Green Purchase Decision (GPD). The study discovered lack of awareness about the availability of green products as the most primary impediment in the way of eliminating environmental problems. All the same, many respondents showed a positive attitude towards the environment. But they are not willing to come forward because of lack of financial support and fear of failure.

Memar, N., & Ahmed, S. A. (2012) conducted their study on the consumers' purchasing decision on eco-printers in Swedish market and analyzed the factors which influenced consumers' green purchase intentions. And they found that green knowledge or eco-literacy, attitude and green belief, environmental laws and guidelines and willingness to pay are identified as strong influencing factors while demographic variables which are found a less strong factor.

Samad, H. A., Khandker, S., Asaduzzaman, M., & Yunusd, M. (2013) examined the effectiveness of dissemination of Solar Home Systems (SHS) by emphasizing the role of subsidy. The study also intended to determine factors affecting SHS adoption, the role of subsidy, and the welfare impacts of such adoption in Bangladesh. In order

to study the benefits, a total of 4000 households were surveyed in 128 villages which is split to Experiment Group (1600 SHS households and 400 non households) and Control Group (2000 non SHS households). The analysis of the study explained that demand for solar systems has phenomenal growth even with a declining subsidy, because of technological developments. Households with physical and educational endowments are adopting the system. This finding endorses with earlier research findings. As a result of SHS adoption there was 68 per cent of kerosene consumption reduction. It's noted that a 10 per cent decline in the price of adoption of solar home system would increase the demand by 2 per cent. The study highlighted many direct and indirect socio economic benefits like reduction of indoor pollution by reducing kerosene consumption, improvement in the children's evening study time, provides health benefits for rural household members, particularly for women and, more importantly, increase in women's decision making ability in certain household matters. The study also suggests different ways for generating income and consumption by solar adoption.

Wang, L., Bandyopadhyay, S., Cosgrove-Davies, M., & Samad, H. A. (2011) reinforces that dissemination of SHS improved the quality of life of people in remote areas of Bangladesh through a national survey**.** Focus is given to review the progress of SHS dissemination in Lower Development Countries (LDCs) and also tried to quantify carbon benefits of SHS. The study generated three key findings, viz. 1) Propagation of solar home systems brings about momentous carbon benefits. It is revealed that if all households without electricity access in Bangladesh are provided with SHS, it would be able to avoid 4 per cent of the total annual carbon emission by replacing kerosene. 2) Geographical targeting of the programme resulted in an upward trend in SHS subsidies in rural Bangladesh are 3) if there is a combination of micro-credit schemes with subsidy availability, market prospective for SHS in many rural areas will improve. It is also found that the propensity to install SHS is very remarkable in the case of high income groups, viz. there is a probability of 12 per cent increase in SHS installation with one per cent increase in per capita income sidelining other variables.

Chavan,A.S., & Welling, M.N. (2013) assessed the awareness of government subsidy on solar water heaters among the people of Mumbai and observed that a majority of them people (52.86 per cent) did not know about the incentives and

subsidies and 74.28 per cent agreed that they would buy the SWH if incentives were provided. They concluded that subsidy has a significant impact on the use of SWH. They suggested promotional campaigns for creating awareness about subsidies and it should be done by the manufacturers and suppliers. Another suggestion of the study was the introduction of single window clearance to accelerate the disbursement of subsidies with minimum time and effort.

Delafrouz,N., Momenpour,M., Goli,A., & Fatemeh. (2014) conducted a descriptive study to analyze the effective drives on consumer green purchase decision by using CFA and SEM model. They analyzed 384 consumers of dairy and meat products of Kaleh Company in Guilan province, Iran. They pointed out Green Purchase Decision (GPD) is environmental friendly behaviour exhibited by the consumers while purchasing goods and services. Results showed that all product dimensions like product, promotion, distribution and price of the green marketing mix affects the consumers' green purchase decision in a positive and meaningful way. Model testing shows that green product has the most impact on GPD followed by green promotion, green distribution and also green price. They also found that sex and age have no effect on green purchase. However, marital status and education have a meaningful relation with green purchase decision. Hence it is suggested that companies should include more environmental aspects in their products because consumers are willing to pay premium for products with environmental standards. Regarding green promotion and distribution, companies should inform their customers about their new initiatives and policies to support environment and follow environmental standards in transportation system. Price must be equal to the value received by the consumers. Therefore it can be summarized that green marketing mixes can enhance the business of companies.

Wu, S. I., & Chen, Y. J. (2014) conducted an experimental research to explore the effect of green marketing awareness and perceived innovation on the purchase intention of Environment Friendly Products (EFP) specifically with an energy saving lamp and environmental cleanser with the mediator variables namely., Perceived Quality (PQ), Perceived Price (PP), Perceived Risk (PR), Perceived Value (PV) and established an overall relationship model. In their research framework, an attempt is made to know how these two independent variables, viz. Green Marketing Awareness (GMA) and Perceived Innovation (PI) would affect the mediator variables (PQ, PP,

PR, PV) and also the purchase intention. By analyzing 320 responses for energy saving lamps and 310 for environmental cleanser among Taiwanese consumers selected through convenience sampling, it was found there was a greater effect of green marketing awareness on purchase intention than the effect of perceived innovation. Results also revealed that the green marketing awareness has a significant positive influence on PQ, PV and PI, while perceived innovation toward green products was found to have a significant positive influence on PQ, PP, PR and PV. Another finding was that Consumers PQ have significant positive influence on purchase intention.

Kumar, B. (2012) investigated the determinants of purchase intention and purchase behavior for Environmentally Sustainable Product (ESP). An empirical analysis through SEM reveals that environmental knowledge has a significant positive relationship with the attitude towards ESP. He also found a stronger significant relation between attitude and purchase intention than Perceived Behaviour control (PBC) and purchase intention. Another important finding is that Subjective Norms (SN) are not significant with Purchase Intention (PI) and purchase behavior (PB). Fundamentally this study discovered that environmental knowledge has a significant positive relationship between Attitude Towards Environmentally Sustainable Products (ATESP) which is the most important determinant of the PI which would finally lead to PB.

Amin, M., Uthamaputhran, S., & Ali, F. (2015) investigated the effect of green positioning strategies on product attributes and customers intention to purchase. They mentioned functional attributes and emotional benefits as two types of product positioning strategies in the current studies and empirically confirmed that both have a positive effect on customer intention to purchase. Functional benefits were recognized as the product offerings, such as value, quality, price, features, while emotional benefits indicated the self image created by customers. He mentioned that emotional linkages are critical in selecting a product by a consumer. However, the study noted the stronger effect of functional attribute over emotional benefits. At the same time, emotional benefits increase the probability of recommendation and also observed the important role of demographic factors in increasing the role of functional attribute.

Huijts, N. M., Molin, E. J., & Steg, L. (2012) helped to comprehend a framework of energy technology acceptance with the support of psychological theories and empirical technology acceptance studies like TPB, and Norm Activation Theory. They tried to explain the intention to act towards/against Sustainable Energy Technologies (SETs) and summarized that attitude, social norms, Perceived Behaviour Control (PBC) and Personal Norms (PN) significantly contributes the intention to act. In the current study, authors recognized that attitude is effected by perceived costs, risks and benefits, positive and negative feelings in response to the technology, trust, procedural and distributive fairness. They highlighted the importance of hedonic motives which included positive (pride, happiness and satisfaction) and negative effects (fear, worries and anger) with cognition as antecedents of attitude. PN is influenced by perceived cost, risk and benefits, outcome efficacy and problem perception (awareness of adverse consequences of not adopting the new technology).They also explored the importance of knowledge and experience in evaluating a technology. The study gives clarification to 'acceptance' as behaviour towards energy technologies and 'acceptability' as attitude, viz. an evaluative judgment towards new technologies. Likewise, citizen acceptance and consumer acceptance, in which former reflects public behavior response. Attitude is classified here into global attitude and attitude toward specific behaviour. They also mentioned individual traits (value, socio- demographics) well as a situational factors (proposed location of the technology, media attention, oil price) which may also affect the intention to act which may have influenced the acceptance of technology, however not involved in the present model.

Diaz Jr, D. (2007) observed the relationship between drives to search for new energy technologies for dropping load demands and interest in PV system**.** He developed a model based on DOI theory with five constructs, viz. motivation, knowledge, experience, familiarity and communication to recognize the factors which encourage interest in solar photovoltaic generation system within the United States Air Force base. Telephone interviews with 28 energy managers from 61 active duty bases used as sample for conducting study. Testing of hypothesis confirmed that there is a positive relationship between motivation to seek new technologies for curtailing energy demand and interest in PV system. He concluded that knowledge, the amount of solar irradiance, peak electrical loads and the population size of a base are the

significant factors for promoting interest. Among these influencing factors, knowledge is the most significant factor promoting interest in SPV.

Arkesteijn, K., & Oerlemans, L. (2005) given insight into the motivating factors for early adoption of green energy by Dutch residential users. They used a comprehensive theoretical approach which integrates cognitive and economic approach. Earlier studies observe that lack of social visibility is an important feature of green electricity. Three sets of independent variables used in theoretical framework, viz. factors connected to technical system, individuals and economic issues. Characteristics of technical system encompass complexity, reliability, level of trust in 'Green Electricity Supplier' and adoption factors related to individuals include 'Individual's Perception of own Responsibility for the Environment', 'Perception of Relative Advantages', 'the perceived importance of the used communication networks'. He conducted a telephone survey among the adopters and non adopters of green electricity in Netherlands, to empirically investigate the hypothesis. By adopting a stratified disproportional random sample of 250 households from stratum were selected and generated 115 responses in which there were 55 green electricity adopters and 60 non green electricity adopters. It is observed that green adopters can be categorized as early adopters because more than 65per cent adopted green electricity for more than one year. Results revealed that a higher level of perceived responsibility for the environment, a higher level of basic knowledge of renewable energy and environmental behavior displayed in the past found to increase the likelihood of adoption of green electricity. This means that if the respondents have experienced with green technology product, they seem to adopt new green technologies.

Feng, H. Y. (2012) tried to analyze the key factors of user's intention of adopting RETs based on TRA, TPB, and Roger's DOI theories to bring out the determinants of consumers acceptance model .He interviewed 273 persons in Taiwan to comprehend their attitude and behaviour about RETs. The researcher used the main constructs for the study as external variables (gender, marriage, age, occupation, education), attitude towards use(perceived usefulness, perceived ease of use, compatibility), acceptance of innovation, subjective norms towards the dependent variable behavioural intention to use. The study reinforces the past findings that a person's attitude must be considered along with appropriate selection of technology which is relevant for effective diffusion of technology and emphasized that "Behaviour Intention to Use" is the

major predictor index for future use. He observed that perceived usefulness is the key factor which influenced people to use RETs. He identified subjective norms, perceived ease of use, while compatibility was also found to be major determinants of the use of RETs. The study hypothesized that attitude is affected by different demographic characteristics and found that income is not a significant variable. He also pointed out gender difference in respect of usability of RETs. Men find more usability for RETs than women do.

Herring, H., Caird, S., & Roy, R. (2007) examined both adopters and non- adopters of Low or Zero Carbon (LZC) technologies in order to find out the drivers and barriers to RET adoption and energy saving measures by conducting an online survey in the UK. He considered four LZC technologies like SWH, PV, micro wind turbines and wood stoves. The study used 400 consumers for conducting a survey which revealed 80 per cent adopters and 70 per cent non- adopters who were concerned about environment. They stated that each LZC technology has different drivers, barriers, benefits and problems. He pointed out saving energy, reducing fuel consumption, reducing fuel bill and concern for environment as the major drivers, while capital cost and anticipated pay back were recognized as major barriers. They opined that high capital cost is a universally approved reason for rejection of SPV. Finding trustworthy installer and suitable location were also stated as barriers. More importantly, grants available for RETs in the UK are not found as a most frequent driver. The survey also revealed that only one third of solar PV users were fairly or very satisfied. It is suggested that better regulation and control must be provided to control cowboy installers.

Keriri, I. K. (2013) examined the extent to which the level of knowledge and awareness of solar technology, income, education, and the availability of substitute power influenced the adoption of domestic solar technology in Kenya. Analysis using a sample size of 365 household heads from Laikipia constituency in Kenya revealed that the increase in knowledge and awareness, level of income and education would lead to increase in the adoption of solar technologies. However, the increase in the availability of alternative technologies would decrease the adaptability of solar technology by the community. The study also found a positive relationship between formal and informal training on solar use and solar adoption.

Labay, D. G., & Kinnear, T. C. (1981) considered the differences between adopters and non- adopters of residential solar energy systems on the basis of selected demographic variables (age, education, family life cycle, and occupational status) , attribute perceptions of solar energy systems, (relative advantage, lower financial risk, social risk, compatibility), and product related factors (economic and social factors). The study is positioned within the adoption and diffusion framework. They employed three types of sublets of population, viz, adopters of solar energy system, knowledgeable non- adopters and non-sensitized non-adopters. By employing Multivariate Nominal Scale Analysis (MNA) and Multiple Discriminant Function Analysis (MDF), 631 individuals were surveyed by mail in the state of Maine and it was revealed that the adopters are younger, highly educated, higher income, earlier in the family life cycle and with higher occupational status. The researcher also observed that adopters perceive greater relative advantage, less risk and less complexity. Demographic factors and attributes of perception were also checked with the time of installation of solar system revealed that there is no significant difference in demographic factors. However difference exists with regard to perception. Recent adopters evaluate solar energy system as better suited with their value system than earlier adopters.

Claudy, M. C., Michelsen, C., O'Driscoll, A., & Mullen, M. R. (2010) explored the role of consumer awareness in the light of DOI framework and the effect of socio-demographic in the adoption of micro-generation technologies in Ireland and it revealed that understanding of consumer electricity needs is a prerequisite. The term 'awareness' was found to have a significant variation between different RE technologies and customer segments. They also indicated that awareness of an innovation depends on personality or socio- economic characteristics. The results also show that women are less aware of these particular technologies. Many researches in green consumerism emphasized that women are more environmentally concerned. However when it comes to renewable energy, this study indicated an opposite result and confirmed that men are significantly more aware of micro generation technologies which provide a scope for further investigations. They also proved that older people and the people in employment, are more aware of micro generation technologies.

Claudy, M., & O'Driscoll, A. (2008) made an empirical investigation of slow rates of diffusion of SPV in mainstream markets despite consumer sensitization on the

product being on the rise. They observed a gap between consumers green preferences and actual adoption behaviour. Therefore an enquiry into attitude behaviour gap in the context of micro generation technologies adopted by the residential sector, mainly focusing on three research issues.

1. Consumers passive resistance (Awareness)
2. Active resistance (Postponement, Rejection and Opposition)
3. WTP for Micro generation technologies

The theoretical contribution of the study is three fold, viz, innovation literature, resistance literature, literature on energy policy domain. They mentioned green products as products created with less material, energy, pollution and waste in the complete product life cycle, viz. extraction, manufacture, supply, usage and dumping. They argues that a technical invention is termed as innovation only when marketing of the invention to consumers or diffusion to market place happens. They observes that commercialization of solar panels is relatively a new phenomenon even though it has existed for decades. They discovered that technical literacy about micro generation still exists in consumer market. They described attitude–behaviour gap as the mismatch between Positive Attitude towards Green Innovation (PAGI) and consumer's actual willingness to purchase. They points out that Value Norm Theory (VBN) and moral and general altruistic considerations are the key illustrative variables for pro-environmental behaviour and tried to conceptualize the antecedents of consumer innovation adoption decision. Passive resistance of consumers indicates lack of cognitive involvement while active resistance is cognitively more involved. Resistance behaviour can occur in the past awareness stage, viz. persuasion, implementation and confirmation stage. They conducted an exploratory quantitative study among the adult population in Ireland, by using non- probability quota sampling technique. Sample size for the study was determined as 1012. Passive resistance, active resistance, WTP, formed as dependent variable and socio demographic factors, perception of functional and psychological barriers, and perception of product characteristics were considered as independent variables. Findings indicated that awareness among Irish population about individual technology significantly differ. Perceived relative advantage (energy savings, environment friendly, independence), perceived compatibility and initial costs constitute perceived functional barriers and

psychological variables represent perceived risks (financial, functional, and social), perceived compatibility with values, SN, perceived complexity and subjective knowledge. Result indicated that younger people (Men) are more likely to have heard about micro generation technology. Results also show that motivation underlying different resistance behaviour varies significantly. Obviously, consumers intend to adopt the technology with low barriers. Householders' decision to adopt is not entirely based on rational thinking and there are other factors other than cost benefit. Owner's perception of product characteristics, social norm, and socio demographic characteristics influence Willingness to Purchase (WTP). Results also revealed that environment friendly perception is translated into higher WTP. It is suggested to that target the postponing customers, overcoming perceived usage barriers with special focus on compatibility with existing infrastructure.

Kalafatis, S. P., Pollard, M., East, R., & Tsogas, M. H. (1999) investigated the effect of Theory of Planned Behaviour (TPB) frame work within the context of green marketing and analyzed the constructs relationship in the UK and Greek market conditions. Through the TPB model, they intends to examine the drivers of consumer intention to buy environment-friendly products in London area from the UK and Athens from Greece with sample size 175 and 170 respectively selected for conducting the study. They concluded that TPB would be more appropriate in developed and more established markets. They found the domination of social norm in the UK market and it is the only determinants of purchase intention. However, SN (Subjective Norm) is found to have an indirect effect through PBC (Perceive Behavioural Control) in Greek sample. Availability of Environment Friendly Products (EFPs) and presence of pressure groups are more in the UK while in Greece, the condition is the reverse (characterized by very few EF products were available in speciality shops and fewer pressure groups). Therefore personal influence is dominant in Greece market.

Smith, S., & Paladino, A. (2009) enquired into the motivational factors behind organic purchases and explains the effect of health consciousness, environmental concern (EC), quality, price consciousness, Subjective Norm (SN), familiarity on organic attitude, Purchase Intention (PI) and behaviour. By utilizing TRA (Ajzen and Fishbein, 1980) framework, he discovers a strong support for the relationship among organic knowledge, SN, EC on organic attitude. Data was collected from surveying

undergraduate students of Australian university with a sample size of 157.They observed attitude influences on the purchase intention. However it did not find any relation between the purchase behaviors. The study also proved that organic knowledge would increase positive attitude. However it did not have an effect on purchase intention and behaviour. Findings of this research throw light on the importance of Subjective Norm (SN) on the consumer's attitude towards organic products. This study also supports the relationship between familiarity and organic purchases, viz. its influence on the purchase intention. In conclusion, health consciousness, quality, SN, and familiarity influence purchase intention and familiarity shows significant relation with organic PB.

Bird, L., Wüstenhagen, R., & Aabakken, J. (2002) examined the determinants influencing the adoption of green power products. He defined green power marketing as differently selling electricity wholly or in part from renewable sources. They made reviews of international green power market, viz. Australia, Canada, Japan, and the US to know to understand the key factors of market penetration of green power products, such as product designs, pricing, incentives, marketing strategies, policies, product certification and consumer response. Emerging green power countries as well as countries in which green power activities are in vogue for several years have been selected for the study. The results showed that most powerful markets have achieved green power penetration of 5 to 15 per cent and most markets reported 1percent penetration rates which need to be developed. He stated that one of the reasons for the slow penetration of these technologies is 'lack of aggressive and targeted marketing' by the suppliers. And he also suggested that the existing utilities of government and non-government organizations needed to overcome lack of knowledge among the consumers, which is the major hindrance identified for the slow penetration of these products in this market. Targeting the appropriate consumer segments and provides necessary information through suitable media is also important for effective information dissemination for consumer retention. He also opined that environmentally conscious consumers are the best targeted segment for these high priced and high quality products in order to avail environmental benefits. It is also pointed out that certification, labeling and government support are the important facilitators of green market development.

Bambauer-Sachse, S., & Mangold, S. (2011) tried to examine the influencing factors on consumers' intention to purchase sustainable products and developed a conceptual model. The author identified that green consumption has increased among consumers. Here researcher tried to mediate the role of attitude and trust on Consumer intention to purchase sustainable products. Findings of the study indicate that belief, knowledge, attitude, company's sustainable responsibility, trust and perceived quality would be influential factors on consumer intention to purchase these products.

Shabnam, S. A. A. D. I. A. (2013) proposed a model for predicting pro-environmental consumer behavior of sustainable products using TPB framework. The researcher tested the linkages between variables such as Environmental Knowledge (EK), Attitude Towards Purchase of environment friendly product (ATB), Normative Belief / Subjective Norm about pro-environmental behaviour (SNB), Perceived effectiveness, Control on availability and consumers Perceived Price (PCB) towards Purchase Intention (PI) and purchase of Environment Friendly Products (EFP) of consumers. She clearly mentioned that such studies happened in developed countries. However, the results can not be applied to developing countries which are distinguished by weak institutional environments, deprived enforcement of law, bureaucratic intricacy, red tapism, social insecurity and corruption. Therefore it's a necessity to understand the EPB of consumers. Pro-environmental consumer behaviour from a developing country standpoint is recognized as a major research gap in the area of environmental consumerism. It would be an important contribution to the existing literature in the area of environmental consumerism. She explained about triple bottom line principle of environmental marketing which includes people, planet and profit.

Baskaran, R., Managi, S., & Bendig, M. (2013) conducted an empirical study about households awareness level of MGTs, the factors determining the adoption and their willingness to adopt in New Zealand. They investigated the public perception regarding MGTs (Micro Generation Technologies) and to analyze the factors influencing peoples' decision to adopt. Results show that respondents were strongly aware of solar thermal technologies and micro wing turbines. However, they had least knowledge about solar PV. They also found that highly educated and income segments do not have a better understanding of MGTs

2.4 Post Adoption Factors

Anderson, E. W. (1994) illustrated how customer satisfaction is used to measure internal and external performance of business. He clarifies that customer satisfaction is internally used to monitor performance, allocate resources, and compensate employees. Externally it is used to provide information to various interest groups, including customers, competitors, investors and public policy makers. He proved that perceived quality, expectation and disconfirmation are the predecessors of satisfaction and the likelihood of repurchase is the consequence of SAT. He described about C/D (Confirmation/Disconfirmation) which is the perceived discrepancy between pre-purchase expectation and after purchase experience in terms of quality with norms or standards. He also described that quality is an antecedent of customer satisfaction and have a positive effect on it. Loyalty, WOM, and complaints are found to be the consequences of customer satisfaction and they also revealed a positive effect of customer satisfaction on repurchase behaviour. In this research, he tried a model linking between the antecedents and consequences of customer satisfaction and found that it is the function of quality, expectations, positive C/D, negative C/D and also reiterated that repurchase likelihood is a function of satisfaction.

Continued Adoption

Hong, S., Thong, J. Y., & Tam, K. Y. (2006) examined the effectiveness of three prominent models, namely TAM, ECM IT and EECM IT for understanding the explanatory power of continued usage behaviour. They reinforced that continued adoption is more vital than initial adoption for the success of an innovation and for the market growth. They conducted the investigations among the experienced users through an email survey in Hong Kong in order to study their intention to continue. Confirmatory analysis and SEM by using LISREL 8.50 well performed and the results indicate that the three models adequately fit with the data. All casual relationships among the models except for Perceived Usefulness (PU) with satisfaction in EECM-IT were found to be significant.

Alamgir Hossain, M., & Quaddus, M. (2011) examined the influencing factors of adoption and their continued intention of Radio Frequency Identification (RFID) adoption in a mandatory and voluntary environment. A field survey from eight organizations through purposive sampling method was undertaken. The survey using

interview method revealed that technological, and organizational characteristics, external environment factors, RFID expectation and self efficacy were the influential factors for RFID adoption and its continued usage intention depends on satisfaction and degree of self efficacy. They used ECT and ECM theories which concentrate only on repurchase intention. However it is not the initial drives for adoption. These two theories reorganize the importance of SAT as the determinant for re-usage intention and they proposed Adoption and Continuance Intention Model (ACiM) which explains both adoption and continued intention. The result revealed that satisfaction conformation and self efficacy are the determinants of Continued Usage Intention (CUI).

Kim, Y. H., Kim, D. J., & Wachter, K. (2013). studied mobile user engagement (MoEN) with engagement motivation, perceived value, satisfaction and continued engagement intention. The research classified the users motivational factors with the cognitive, affective and conative contexts. The study examines the user engagement motivation by including utilitarian motivation, and perceived value within the cognitive stage, hedonic motivation and satisfaction in the affective stage, social motivation between cognitive and affective stage and mobile user engagement intention as their conative attitude. Empirical validation of the MoEN model conducted by studying 604 data collected from undergraduate students from South Eastern University in the U.S, who were actual smart phone users. Studying user's motivation to engage in activities will provide insight into further explanation of their continued engagement behaviour and this will make them loyal. Findings indicate that three engagement motivations of mobile users have a strong positive effect on overall satisfaction and mobile engagement intention and overall satisfaction shows a strong positive effect on users' continued engagement.

Wangenheim, F. V., & Bayón, T. (2007) tried to fill the research gap by identifying ways to quantify WOM communication from returned customers by investigating the linkage between customer satisfaction, WOM and new customer acquisition. He throws light on how SAT transforms into PWOM and how PWOM converts into the acquisition of new customers. He found that the link between WOM and SAT is non-linear and mediated by other customer involvement dimensions. WOM is regarded both as consequence of SQ and customer SAT and an antecedent to returns and profit due to new customer acquisition. Results also show that Return on Satisfaction

increases in the form of new customers through WOM. Moreover, this research gives thrust to on the complete chain from SAT to new customer acquisition

Averdung, A., & Wagenfuehrer, D. (2011) applied modified (Technology Acceptance Model) TAM to explain the acceptance and post adoption behaviour of environmentally sustainable innovation based on TRA (Theory of Reasoned Action) and TBP (Theory of Planned Behaviour) framework. The study used a randomized sample of 105 first time users of eco-technology in Germany. They describe antecedents of 'the behavioral intention and WTP (Willing to Pay more) and consequences of initial purchase action and social contagion (WOM). They considered independent (exogenous) variables as novelty seeking, ecological attitude, comfort of use and mediating variables as trust, perceived usefulness and loyalty towards measurement of dependent variables, WOM (Word of Mouth) and WTP (willingness to purchase). The result of the survey revealed that comfort of use has a direct influence on WTP and confirmed WOM as the key success factor in the dissemination of marketing strategy. Loyalty, usefulness and trust place a mediator role for the explanation of WOM. The study also reported the direct effect of novelty seeking on ecological attitude. Researchers were of the opinion that not only environmental sustainability but other factors like word of mouth will constitute a major factor for the consumers to pay more. Among the studied variables the intention to pay more is directly influenced by comfort of use, and word of mouth. Other variables like novelty seeking, and ecological attitude directly affect loyalty, usefulness and trust which serve as a mediating variable towards the dependent variable- word of mouth. Hence it is concluded that environmental sustainability is not a major factor for the consumer willingness to pay more and at the same time word of mouth is found to be critical in this process.

Chang, N. J., & Fong, C. M. (2010) investigated the relationship between green product quality, green customer satisfaction and green customer loyalty. He reviewed two different conceptualizations of satisfaction, viz. transaction specific customer satisfaction and cumulative customer satisfaction. Earlier it was a post purchase evaluative judgment of a specific purchase occasion. However later it was an overall evaluation based on the overall experience with the goods and services. Even though he spoke about loyalty from three perspectives (behavioural, attitudinal, and situational) attitudinal form of loyalty is of major importance for companies.

Consumers who were experienced with green products were selected as sample for the study. Out of 600 questionnaire distribution, 196 valid questionnaires (32.67%) constitute the final sample size for analysis. The model verification through SEM revealed that green product quality has a positive association with green customer satisfaction and green customer loyalty.

Han, H., & Kim, Y. (2010) tried to extend the TPB model by including service quality, consumer satisfaction, overall image and frequency of past behaviour and found that these are the significant predictors of post purchase decision. An internet based survey of 469 valid responses from general hotel customers in the US formed the sample for the study. They indicated that attitude towards revisiting a green hotel is affected by the increase in perceived service quality and satisfaction level of the customers. The extended TPB model is well supported, the study also found that SQ,(Service Quality) satisfaction and overall images have a significant positive association with revisit intention (RI). More importantly, frequency of past behaviour also proved to be a significant predictor of intention. Only customer satisfaction and attitude were found to have significantly mediated the impact of SQ on RI. SN also proved to have a significant influence on attitude towards revisiting a green hotel. Therefore it is concluded that additional variable inclusion significantly increased the predictive power of customer's intention to revisit a green hotel and SAT and attitude played a mediation role between service quality and intention.

Bei, L. T., & Chiao, Y. C. (2001) tried to explore the effects of product quality, service quality and price fairness on consumer satisfaction and loyalty and concluded that the above mentioned three consumers' perceptions are equally important for achieving satisfaction. The study employed three secondary data sets of service quality from gas stations, banking and auto repair and maintenance industry which had different levels of intangibility. They also revealed that Perceived Service Quality (PSQ) which was the major construct contributing directly to consumer loyalty through satisfaction. However, the other two constructs proved to have direct and indirect effects on loyalty. Finally, the results showed that PSQ has a direct and positive effect on customer loyalty and indirect and positive effect on customer loyalty through customer satisfaction. Therefore, it is suggested that higher quality is necessary for enhancing customer satisfaction and boosting customer loyalty.

Cengiz, E., & Yayla, H. E. (2007) tried to study the relationship between marketing mix and WOM and they created an integrated model and tested through SEM among the 503 Turkish customers and the result indicated that price, product, promotion and place (marketing mix components) have an effect on WOM. The effect of marketing mix on WOM via five factors i.e. customer satisfaction, customer loyalty, customer expectation, perceived quality and perceived value, is confirmed and product and promotion component are specifically found to have a major influence on WOM communication indirectly.

Chan, R. Y. (2001) examined the influence of the cultural and psychological factors on the green purchase behaviour of Chinese consumers. Incorporation of cognitive, affective and attitudinal constructs (Two cultural value dimensions, like man- nature-orientation and collectivism and Attitude towards Green Purchase (AGP), ecological knowledge) into the model provided insights into how these variables effects attitude towards performing a specific kind of eco-friendly behaviour. A comprehensive survey of 600 households was conducted in China to empirically verify the model. They prepared a conceptual model and empirically verified and confirmed through SEM the influence of ecological knowledge effect on green purchase attitude which leads to GPB via the mediator variable of green purchase intention. It also confirms the influence of cultural values effect on AGP.

Chen, T. B., & Chai, L. T. (2010) tried to investigate the effect of consumer attitude on the government role and their personal norm towards the environment to their attitude towards green products. The study elucidated that personal norm was the most important factor contributing to the attitude towards green products. The study also revealed that environmental protection did not contribute significantly towards consumer's attitude on green products and also stated there is no significant difference between gender in their environmental attitude and attitude toward green products.

Gremler, D. D., Gwinner, K. P., & Brown, S. W. (2001) investigated the interpersonal relationship between employees' and customers' effect on PWOM. Authors empirically verified the propositions among bank customers and dental patients' contexts in the US with a randomly selected sample size of 1303. They realized that WOM communication from an existing customer to a prospective customer is often the most plausible method of stimulating new business for firms and

PWOM communication is a precious medium for promoting a firm's products and services. They empirically investigated the proposed model by performing CFA and found a significant correlation between PWOM and four dimensions – trust, care, rapport, and familiarity and revealed that trust act as a consequence of other three interpersonal relation dimensions. Results also claimed that the above mentioned four constructs are important interpreters of WOM behaviour. They state that interpersonal relationship between employees and customers is sufficient for encouraging PWOM communication.

Lynch, D., & Martin, P. (2010) reviewed TPB framework and applied it to study the influence of energy efficiency programme on participants' behavior in the context of Central Victoria Solar City (CVSC), Australia. They considered energy efficiency as one of the national priorities. They conducted a randomized controlled trial (experiment design) with intervention group (randomly assigned treatment) and control group (non treatment). They analyzed it in the context of CVSC programme which is intended for reducing usage of conventional energy and improving energy efficiency. They recommended that TPB is a plausible model to explain energy use intention and behaviour. They noticed that intentions to reduce energy use were influenced by environmental and financial attitudes towards energy consumption reduction and perceived control over such behaviour. The study also throws light on the effectiveness of government intervention to address the investment inefficiencies. They recognized two basic approaches for achieving the targeted emission reduction, namely market regulated approach and regulatory approach. They discussed curtailment and efficiency behaviour of household energy conservation efforts. Curtailment behavior represents everyday action that requires to conserve energy and efficiency behaviour represents buying efficient appliances and installations. They mentioned that efficiency behaviour found to be greater than that of curtailment behavior. Authors mentioned pigouvian tax and also mentioned sustainable behaviour / accelerating the penetration of energy efficient technologies .It can be inferred that these programmes would be helpful for the market transformation of decentralized technologies. The study found that energy consumption is influenced by social and environmental values, situational variable (physical infrastructure, geographical location, socio-economic structure and knowledge) and psychological factors (attitudes and social norm). Finally, it is implied from the study that the programme

was successful which encouraged the participants to change their energy usage. The study also revealed that subjective norm of PBC found has no significant effect on influencing behaviour in the context of other attitudes and beliefs. They suggested further research on subjective norms on energy consumption. It is also noted that programme participation did not strengthen the influence of attitude and beliefs on intention to reduce energy use or actual behavioural change.

Dagher, G. K., Itani, O., & Kassar, A. N. (2015) analyzed the moderating effect of gender on the relationship between environmental concern (EC) and Attitude towards Green Purchasing Behaviour (AGPB). This is a socialization theory based study and one notable finding is that marketers, educators and policy makers need to know the uniqueness of each market in order to accelerate green behaviour. He mentioned green consumerism is a complex concept and it represents decrease in pollution, environmental preservation and sustainable use of non-renewable resources. Consumers' sensitivity towards the environment has skyrocketed for the past few years and they express their environment-friendliness by purchasing Environment-Friendly Goods and Services (EFGS). In their study, focus is given to gender differences in AGPB. Even though many studies investigated this issue, a consensus has not been reached. Some found that females have a high Ecologically Conscious Consumer Behavior scores (ECCB) and some pointed out peoples recognition of the public consequences of their private consumption. Findings reveal that gender found to have a significant moderating effect on environmental concern and AGBP.

Bang, H. K., Ellinger, A. E., Hadjimarcou, J., & Traichal, P. A. (2000) investigate the relationship of three variables , viz, 'concern with the environment', 'knowledge about renewable energy' and 'beliefs about salient consequences of using renewable energy' with 'consumer attitude toward paying a premium for renewable energy' by using the theory of reasoned action, and the result indicated a positive relationship between beliefs about salient consequences and attitude towards paying more for renewable energy. The study also indicates that the overall concern level is high and knowledge level was relatively low.

Oh, H. (1999) tried to assess the role of consumer value within existing SQ and customer satisfaction framework. He tried to explain the relationship of consumer value with price, perception of performance, SQ, customer satisfaction and intention

to repurchase and recommendation. He observed that perceived value is the direct antecedent of a purchase decision and direct outcome of service quality.

Cronin, J. J., Brady, M. K., & Hult, G. T. M. (2000) tried to investigate the integrated effects of service quality, satisfaction and service value on customer behaviour intentions. They revealed a direct effect on customer behaviour intentions when all the three variables were simultaneously considered. They mentioned that service quality is an important determinant of behavioural intentions. The study focused on various convergent (interrelationships) and divergent (direct effects) literatures and identified several competing theories in order to propose the model. Previous studies also showed antecedent, mediating and consequent relationships among these variables. As declared by Zeithamal, Berry, Parasuraman, (1996) researchers also affirmed favourable behavioral intentions are

1) speak positive things
2) Recommend
3) stay loyal
4) Spend more with the company
5) Pay price premium

Cronin Jr, J. J., Smith, J. S., Gleim, M. R., Ramirez, E., & Martinez, J. D. (2011) conducted research to appreciate the role of "green" on a marketing strategy. The finding of the study was that the firms appear to have a better understanding of stakeholder & consumer perception, in order to reap the financial rewards linked with green strategies. They also discuss about the lack of green knowledge of consumers. They opined that continuous contributions from suppliers, government legislations, policies and the people are required for the success of green marketing and the success of green products depends on adopting or changing consumers' attitude and behaviour towards such products.

Naing, K. W., & Chaipoopirutana, S. (2014) tried to investigate the relationship between perceived quality, product image, consumer aspirations, emotional value, consumer uncertainty and attitude towards products and purchase intention of smart phone in Malaysia. The result indicated that there is a strong positive relation between

perceived quality and emotional value and also a moderate positive relation between perceived quality and purchase intention. The study explored the relation between emotional value and purchase intention. Thus, it is summarized that perceived quality, emotional value, consumer uncertainty, product image, consumer aspiration and attitude towards product are found to be the factors are reckoned for determining the purchase intention.

Casaló, L. V., Flavián, C., &Guinalíu, M. (2008) tried to examine the role of satisfaction and website usability for increasing customer loyalty and Positive Word of Mouth (PWOM) in e-banking services context. The finding revealed direct effect of satisfaction on loyalty and indirect effect of satisfaction on WOM through loyalty. SAT played a mediating role in the development of customer loyalty and PWOM. Perceived utility is found to be an indirect antecedent of both customer loyalty and positive WOM through satisfaction. They concluded the study stating that consumer satisfaction and loyalty are found to be the key determinants of WOM.

Jiewanto, A., Laurens, C., & Nelloh, L. (2012) tried to find out the positive impact of Service Quality (SQ) on Satisfaction (SAT) and Word of Mouth (WOM) intention. They mentioned that WOM intention has the power to determine/predict the strong recommendation tendency to colleagues and family member. The study intended to measure dissatisfaction among students regarding service quality. By using Structural Equation Modelling (SEM) and Confirmatory Factor Analysis (CFA), they measured the impact of simultaneous variables, viz. the influence of SERVQUAL to Word of Mouth intention (WOM) mediated by student satisfaction and university image. In this study, student's satisfaction and attitude towards university acts as an intervening variable that mediated to increase WOM intention. They used a sample of 140 students selected through purposive sampling technique in Pelita Harapan University Surabaya (UPHS), Indonesia. By using SEM, the results revealed that SQ has a positive impact on SAT and WOM intention. However, WOM intention was negatively influenced by SERVQUAL and student satisfaction. So we can conclude that SERVQUAL in that university is good because it shows a positive impact on student satisfaction and university image. However the satisfaction is not enough for the students to indulge in positive WOM. Finally the study suggested an increase in the five dimensions of SERVQUAL namely tangibility, reliability, responsiveness,

assurance, and empathy in order to increase students' WOM intention regarding education sector.

Claudy, M., & O'Driscoll, A. (2008) explained that a thorough understanding of behavioral aspects of household consumers is necessary for the uptake of Sustainable Energy Technologies (SETs) and for the success of the government policies for RETs. Determinants of renewable energy adoption and the interdependencies among personal and contextual factors may differ between countries and region. They mentioned about VBN (Value-Belief–Norm Theory) which states that the key explanatory variables for conservation behavior are moral and general altruistic considerations. They emphasized the importance of TPB and clarified the RE adoption from economic, technological and behavioral context. Technological and financial risk is the major perceived risk by the consumers while making an investment. Hidden cost involved in searching for the suppliers, installers and also act as a prohibiting factor for the technology. Energy saving potentials, regulatory and legal barriers, negative attitude of energy providers, restricted access to the main grid, unfair charge for backup power and permitting procedure, space requirements are also acts as the obstacles.

Yazdanpanah, M., Komendantova, N., & Ardestani, R. S. (2015) reported that socio psychological factors would have a significant influence on the decision to adopt RETs in Iran. The author also tried to apply TPB framework and the survey revealed the important role played by the stakeholders. The result of the empirical analysis through SEM revealed that the willingness to use and public acceptance towards REs influenced by moral norms, attitudes, PBC at the same time Subjective Norms and self identify have not played a significant role.

Hosseinpour, M., Nezakati, H., Sidin, S. M., & Yee, W. F. (2016) tried to examine the influencing factors on consumer's intention to purchase sustainable products and developed a conceptual model of consumer's intention to purchase sustainable products. Findings of the study indicate that belief, knowledge, attitude towards company's sustainable responsibility, trust and perceived quality would be influencing factors on consumer intention to purchase these products. More importantly, the mediating roles of attitude and trust are considered in this research. They emphasized that ethical /sustainable consumption increased remarkably among

consumers. Moreover, there are differences in consumer behaviour all over the world. Therefore, attitude towards sustainable products will play a major factor which positively affects the consumer behaviour.

Kassim, N., & Asiah Abdullah, N. (2010) made an effort to study the impact of Word of Mouth (WOM) on trust and intention. They examined the customer loyalty through emotional loyalty (WOM) and behavioural loyalty (retention intention). They investigated the effect of perceived service quality dimensions on customer satisfaction, trust and loyalty in Malaysia and concluded that service quality has a significant impact on satisfaction and consumer satisfaction has also a significant impact on trust. Both customer satisfaction and trust have a significant impact on loyalty through WOM. They illustrated WOM as a predecessor to repeat visit or repurchase intentions. The study also looked into the effects of satisfaction and trust on WOM and intention and the link between WOM and intention. Intent to purchase or repurchase captures the behavioral component of loyalty. Customer loyalty is behaviorally expressed by retention (Bansal and Taylor 1999) and emotionally (Ranaveera and Prabhu, 2003) expressed by WOM. Satisfied customers definitely engage in Positive Word of Mouth (PWOM) and it is the vital driver of recommendation and repeat intention. Intention to recommend and satisfaction simultaneously capture attitudinal component of loyalty. Customer satisfaction positively related to WOM and retention intention. Both satisfaction and trust have significant effects on WOM while WOM is found to have an effect on repeat visit and repurchase intentions. Thus satisfaction and trust play crucial roles in constructing customer loyalty. Results also suggest that companies can improve customer loyalty directly by increasing ease of use.

Mittal, V., Ross, W. T., & Baldasare, P. M. (1998) tried to investigate theoretically and empirically about the link between attribute level performances, overall satisfaction and repurchase intentions and observed that negative performance of an attribute has a larger impact on overall satisfaction and repurchase intention than positive performance has on that same attribute. Authors' point out that a customer satisfied with an attribute may be dissatisfied with another attribute. They clarified that consumers would appraise their post purchase experiences of satisfaction at the attribute level. They also pointed that attribute level studying of satisfaction would help a conceptual and empirical understanding of the phenomenon. The study also

found that repurchase intentions are directly affected by attribute performance in addition to the effect through satisfaction.

Mittal, V., & Kamakura, W. A. (2001) tried to present a conceptual link among satisfaction, repurchase intention and repurchase behaviour. They mentioned that theoretical satisfaction ratings should be linked to repurchase behaviour. The paper identified moderating effect of customer characteristics on repurchase behaviour. They tried to prove the customers with the same satisfaction ratings but with different characteristics may exihibit different levels of repurchase behaviour. They indicate about the thresholds and tolerance levels. They argued that customers with different characteristics have simultaneously different thresholds and repurchase behaviour. Therefore, there should be systematic variation in the translation from satisfaction to repurchase behaviour. Lower threshold indicates a higher level of tolerance and as a result higher probability of retention.

Socio Demographic Differences

Liere, K. D. V., & Dunlap, R. E. (1980) investigate social bases of environmental concern and tested five popular hypotheses including socio demographic variables ,namely age, social class, residence, political and sex hypotheses stating relationship between Environmental Concern (EC). They discussed the degree of supportiveness through empirical evidences. Age hypothesis states that youths are more supportive of pro- environmental ideologies and environmental reforms than elders. Social class is expressed in the form of education, income and occupational status and gives a logical explanation that upper and middle class people who are already satisfied with basic material needs. They will find time for aesthetic aspects of human existence. Residence hypothesis shows that urban people are more environmentally concerned than rural people. The plausible explanation for this was rural people possess a utilitarian attitude towards the environment due to their connection with extractive type occupations.

Laroche, M., Bergeron, J., & Barbaro-Forleo, G. (2001) investigates the demographics, psychological and behavioral profiles of consumers who are willing to pay more for EFPs. He reiterated the findings from Coddington, 1990, that 67 per cent of the Americans showed WTP of 5 to 10 per cent more for ecologically compatible products in 1987. Further, by 1991, it became 15- 20 per cent as per the study of

Suchaerd and Polonsky. And in 1993, a mail survey among the UK female consumers revealed that 79 per cent of the sample agreed to pay up to 40 per cent more for a product. He mentioned that even though females are projected as more environmentally conscious consumers by recent studies, most findings about the demographics on their environment conscious behaviour are contradictory. However, the significant influence of socio demographic variables could not be avoided.

2.5 Barriers

Palm, J., & Tengvard, M. (2011) conducted a study to examine the motives and barriers to household adoption of micro generation technologies and the perception difference by the actual and potential adopters. They identified and explained six important motives, namely concern for environment, acting as an example for others, protection against energy companies, self reliance, financial reason, production of own energy. The respondents exhibited their unwillingness about leaving an ecological footprint on the earth. The adopters perceived the investment made in small scale power plants as a way for demonstrating their environmental consciousness. They also discussed the hindrances for adopting these technologies. High upfront cost and low production efficiencies relative to price were identified as the most important obstacle. Consumer perception of maintenance of system, suitable space for locating the system, subjective norms are also identified as barriers. Most importantly, they described that the dropping decision of potential consumers happening when they realize the fact that they can produce only a small fraction of electricity required and they compare a cost benefit evaluation

Lesieutre, A. L. (1992) tried to examine previous experience and effectiveness of residential solar use and evaluated the incentives for removing identified barriers to solar adoption. He reviews the development of solar energy use in the ancient Greece, Rome and Southern California and classified the barriers into physical, economical and social. He also evaluated the incentives which used for reducing these barriers. He concluded that physical barriers lead to economic and social ones which are the most difficult to overcome. Physical barriers which represent which restrict resource availability, economic barriers constitute the factors which effect the home owner's ability to afford solar energy system and social barriers are the most challenging

which comprise the people's or communities attitude, characteristics or perception which restrict people's willingness to adopt solar energy systems.

Margolis, R., &Zuboy, J. (2006) in their report from National Renewable Energy Laboratory (NREL) titled "Non technical Barriers to Solar Energy Use, Review of Recent Literature" reviews the nontechnical barriers to solar energy use. The most frequently identified key barriers are inadequate support of government policy in RE, deficiency in information dissemination and consumer awareness on energy, high upfront cost, difficulty in prevailing over conventional energy systems, insufficient financing options, failure to include all cost and benefits of energy choices, dearth of manpower and training, inadequacy in codes, standards, interconnection and net metering guidelines, pitiable perception by public regarding renewable energy system aesthetics, participation in energy choices and RE projects by stakeholder/community. Unpriced costs and unpriced benefits and lack of trained qualified installers, lack of communication, accessible demonstration, high payback period, lack of emphasis on nonfinancial benefits of PV, lack of community involvement and support are important reasons for market failures.

Claudy, M. (2011) investigated consumer resistance in the direction of green innovation in the context of micro generation. He states that innovating companies would face consumer resistance to green innovation in their marketing effort. He pointed out that diffusion of micro generation technologies has great possibility to help Ireland to generate positive shift in energy usage patterns. The result proved that, not only cost benefit analysis is the major factor while taking purchase or investment decisions by home owners, however influenced by other factors. He states that the gap between WTP (willingness to pay) and actual market price is large and he opined that market based options, such as consumer finance, leasing and fee-for service models are more practicable than financial incentive mechanism. The companies should given focus to Cost-value perception, perceived compatibility, and social image.

Dhoubhadel, S. (2010) conducted her study in Kathmandu Municipality in Nepal to determine the attitude of people towards solar technology and their willingness to pay for solar home lighting system (SHS). She tried to analyze about the types of SHS availability in the market, their costs and assessed which of these products are most

suitable during load shedding. The findings of the study revealed that the majority of the respondents considered SHS rather expensive and preferred using cheaper energy sources. The study revealed that high installation costs and lack of awareness, the question on the systems quality and load capacity are the main barriers. It was also explored from the study that majority of the respondents were willing to purchase the system immediately if there was a high subsidy and the initial installment cost amounted to below rupees five thousand and concluded that most of the respondents preferred to paying in monthly installments toone time payment.

Balcombe, P., Rigby, D., &Azapagic, A. (2013) conducted an empirical study and identified the motivation and barriers to adoption of Micro Generation Technologies (MGTs) among the UK population. Findings indicate that the motivation factors and barriers differ between segments of population. The most commonly identified motivation factors are environmental benefits, saving money through Incentives, reduced fuel bills, and capital cost for installation was identified as the most important barrier. At the same time, inconvenience, impact on residence, uncertainty and trust are also considered as barriers. They analyzed the socio- demographic factors' effect and found that younger age groups are more interested ininstallation, however, they are not reaching the point of installation. Their desire couldn't translate in to actual purchase. Similarly, large houses showed preferences for MGTs installation. Consumers with high income and education (academic elite) are more likely to adopt MGTs. They stated that policies have not been able to not been able to reduce the capital cost even though the implementation of FIT has modified the likelihood of adoption of the Micro Generation Technologies (MGTs). Definitely environmental concern was found to have some influence on motivation to install MGT, however not on consumers' Willingness to Purchase.

Brown, M. A. (2001) described the market failures and market barriers in the US. He clarified that public intervention can overcome market obstacle. Market barriers include giving low priority to energy issues and market failures caused by misplaced incentives, un-priced costs, insufficient and incorrect information, and inadequate fiscal and regulatory policies

Karakaya, E., & Sriwannawit, P. (2015) conducted an investigation into the barriers which hinder the SPV penetration despite the trajectory growth of PV, accompanied

by cost reduction. They reviewed the publications from 28 countries from four continents, namely Africa, Asia, Europe and America which represent all income levels. The study revealed that the barriers may vary across context and divided into socio technical, management, economic and policy. The authors emphasized the importance of participation of all stakeholders, viz. adopters, local communities, international organizations, financial institutions and governments for development of PV adoption.

Reddy, B. S. (2001) conducted an empirical study on Perception, Awareness of REs, Role of MEDA, cost and benefit, barriers to adoption of solar water heater and wind in Maharashtra, India. They surveyed 80 households through direct interview with regard to Solar Water Heater (SWH) and found that lack of information, high initial cost and non- availability in the market as the main barriers. Low electricity bill, uncertain savings, uninterested consumers and maintenance problem are also found to be the major barriers for SWH adoption. They classified and ranked the barriers viz., awareness and information.

Reddy, S., & Painuly, J. P. (2004) survey among households and policy holders to study their views about the diffusion barriers of RETs in Maharashtra, and the study confirmed that the barriers were lack of awareness and information, financial and economic, imperfect competition, uncertainty in future price of conventional as well as RETs, institutional, regulatory and behavioural aspects .

Egbue, O., & Long, S. (2012) analyzed the socio-economic barriers to the consumer adoption of electrical vehicles (EVs) among faculties, staff and students of Technological University in the USA in order to reduce the dependence on fossil fuels and Green House Gas (GHG) emissions. They mentioned that the early adopters will accept EVs only if they perceived any relative advantage or superiority in Electric Vehicles (EVs) compared with Conventional Vehicles (CVs). The result is also consistent with the previous studies related to the barriers to adopting RETs, viz. lack of knowledge, high initial cost and low risk tolerance. They noted that the incentive to subsidize the cost of EVs has little effect on its acceleration. One important finding is that attitude, knowledge and perception differ across gender, age and education groups. Environmental attitude influence the EV adoption and socio technical barriers

like battery performance still exist. More importantly, they highlighted the importance of non- financial benefits for the uptake of EVs.

Jager, W. (2006) tried to study the motives for adoption of PV in a behavioural – theoretical perspective in Netherland discusses technological and bureaucratic barriers and states that the adoption of PV is a high involvement decision and includes cognitive effort. They observed that the adopters group is of highly educated, high income, and middle aged groups.

Alazraki, R., & Haselip, J. (2007) critically assess the impact of small scale PV system installed in homes, schools and public buildings in Argentina and states that PV has the potential to provide a viable and sustainable alternative to overcome the physical and economic barriers. By giving sufficient supply of electricity to rural communities, we can improve the standard of living in LDCs.

2.6 Conclusion

After reviewing existing literature review, it is found that there are a number of determinants which drive the pre-adoption towards RTPV. At the same time, the post- purchase behaviour is also very relevant since it decides its long term market success. Literature also gives empirical evidences of antecedents and consequences of SAT. It is understood that the behavioural theories, namely TPB, TRA and theories from Technology Adoption TAM and DOI are also used in RE energy adoption and its continued usage studies. Therefore in the current research, it is decided to develop a new model by integrating relevant construct from these theories and including some additional constructs which are found to be important in RE adoption. The chapter also gives the barriers which exist in the Kerala RTPV market that will help to attain a clear picture.

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CHAPTER 3

AN OVERVIEW OF GREEN ENERGY SCENARIO

CHAPTER – 3

AN OVERVIEW OF GREEN ENERGY SCENARIO

Section 1. Green Energy

3.1 Introduction

Economic development and environment are the two sides of the same coin and environment plays a protective and promotional role in the success of humanity. Our ancient civilizations consider the environmental powers like the sun, the wind, the ocean as gods and continued to admire these universal powers. That was the culture of ancient India and they consider our planet as mother Earth who gives all necessities for the survival of human race. The religious teachings of Jainism, Buddhism, Taoism also reiterate the importance of environment. Epics like the Ramayana, Shantiparvam of the Mahabharata, Arthasasthra, Atharvaveda, Ishavashya Upanishad explained the harmonious relationship between man and his environment and recapitulates that the earth and its resources have to be worshipped and conserved. Bhagavat Gita also emphasized that if man helps in protecting nature then nature will also protect man in return"(Sen et. al., 2010) ."The development and growth of agriculture, aquaculture, architecture, navigation, animal husbandry, transportation and arts and crafts are possible with the availability of natural resources"(Gupta, 2014).

Today our planet is warming at an alarming rate due to environment degradation contributed by human action in the name of economic development, especially as a result of fossil fuel use. Global warming and climate change have become the buzz words among the policy and scientific community, but still not reached ordinary rural and poor people who are the most vulnerable victims of these issues. The changes in the environment structure are causing in the form of destruction of ozone, degradation of land, melting of ice, rising sea levels, acid rain, drought, floods, hurricanes, ash generation, air pollution, marine pollution, loss of bio-diversity, low level agricultural production and increased levels of Green House Gas (GHG) emission like carbon and these all will have an indirect negative impact on

human health such as vector-borne deceases and finally lead to malnutrition and poverty. This condition will not lead to achieving our Millennium Development Goals (MDGs) which is important for a developing country like India. The reasons behind environmental degradation are increasing size of population, consumption of natural resources for economic development, industrialization and the technology used for production and consumption of these resources. Current global population would account for 7.6 billion people and the prediction of demographers is that it will stabilize with approximately 10 billion people by the year 2075 **(**Vaikunthe, L.D., 2007). According to a UN report (2014) global urban population is set to increase by 2.5 billion by 2050, with nearly 90 per cent of the increase in Asia and Africa. This increased population will contribute significantly to disturbing the planet's eco equilibrium through the increased usage of resources. The impact on environment by humans can be expressed by using a simple formula (Meenakshi, R., 2007). IMPACT=P*A*T, where P=Population Size, A=Per Capita Consumption of Resources and T=Environmental Damage Inflicted by technology to supply each unit of consumption.

It has been established that per capita energy consumption is a key pointer of development. When considering the global and national scenario, the generation of electricity is the major source of environment pollution which is ascribed to mining, transportation, processing and use of carbon-based fossil fuels to a large extent. However, energy access is one of the largest issues faced by a developing economy which intends to be green in future. The following table reveals the link between Millennium Development Goals (MDG) and energy accessibility.

Table No. 3.1

Millennium Development Goals links to Energy access

MDG	How modern energy help in attaining the MDG
To eradicate extreme poverty and hunger	Increases household income by improving productivity
To achieve universal primary education and promote gender equality	Provides time for education, facilitating teaching and learning by empowering especially women and children.
To reduce child and maternal mortality and reduce disease	Improved health, access to clean water, cleaner cooking fuels, heat for boiling water and better agricultural yields.
To ensure environmental sustainability	Cleaner fuels, renewable energy technologies, and energy efficiency can help to reduce environmental impacts

Source: Modi et al.(2006)

3.2 Global Energy Scenario

When looking at the world energy scenario, a major demand coming from Non-OECD countries in which China and India account for two third of the growing energy demand. As per IEA 2016 projections, 76.3 per cent of the global electricity generated through conventional sources, balance 23.7 per cent through RES. Out of the 23.7 per cent, 16.6 per cent is contributed by hydro power, 3.7 from wind power, 2.0 through solar PV and 0.4 per cent from geothermal, Concentrated Solar Power (CSP) and waves (REN 21,2017).

3.3 GHG Emissions and Energy Usage

As per (IPCC 2007), there is a scientific consensus that combustion of fossil fuels accounts for around 70 per cent of total GHG emission into the atmosphere and this caused earth temperature to rise. The Emission Gap Report of UNEP throws light in to Paris agreement on climate change at the Conference of Parties (CoP-21) in 2015 in which countries provided their Intended National Development Contributions in order to keep the atmospheric temperature rise below 2 degree celcius, above pre industrial level and further efforts to limit it to 1.5

Table. No: 3.2

Energy related Carbon Emissions per year from burning Fossil Fuels, 2014

Country	Percentage share of World Emission(in Gt)
China	8.6
North America	6.2
EU	3.2
India	2.0
Russia	1.7
Japan	1.2
Latin America	1.2

Source: IEA, 2015

Table 3.2 reveals that India stands at fourth position which accounts for 2 Gt Carbon Dioxide (CO_2) emissions after China, the United States, and the European Union. However it also implies that developing countries emit carbon to the environment as a part of survival, but industrialized countries for meeting their luxury needs.

Historically developed countries were responsible for most of the anthropogenic Green House Gas (GHGs) emission into the atmosphere and the resultant climate deterioration. Even though developing countries like China and India have lower per capita Co2 emissions than world average, it is also noteworthy that as per IEA projections, developing countries would overtake the OECD countries in global Co_2 emissions. The total carbon released into the atmosphere as carbon dioxide by an average US resident is about 260 tonnes, whereas it is about 6 tonnes for the average resident of India (Chokkar, (2004). According to Global Carbon Project, (2007) developing countries with 80% of the world population account for only 20% of the cumulative emission since 1751. By recognizing the huge difference between developed and developing countries, UNFCC incorporated the principle of "Common but Differential Responsibility". However recently these developing countries contributed larger share to GHG emissions. As we shed light on historical climate policy stand point, the discussion related to human incorporated climate change first

materialized as an international agenda in 1979 at World Climate Conference, and IPCC is the consequential effort by UNEP and WMO in 1988.

3.4 Green Inclusion in Energy Sector

The term "Green" is generally used for describing things that are good for the environment. Environmental movement started in 1830s when George Catlin introduced an idea of national parks in the USA for wildlife preservation. International environmental conventions and conferences have raised the awareness level about conservation of environmental resources and the need of mitigating climate change issues at a global level. Modern environmentalism started in 1950 s and became more active in 1960 s which led to the national environment policy. First earth day was held in 1970 and the first united conference on human environment was held in Stockholm in 1972. The Earth Summit was held in Rio de Janero in 1992, the world summit on Sustainable Development in Johannesburg in 2002, Montreal protocol (1987), UN conference on Environment and Development (1991), Kyoto protocol on green house gases, and the latest Paris summit are some of the major initiatives which created an awareness among people about the necessity of preserving planet earth. The development of Carbon markets for trading carbon emissions (emergence of CDM related CERs) also help industrialized countries in their CO2 reduction commitments under Kyoto Protocol. Thirty years before, a book named "Limits to Growth", warned us about the symptoms of the depletion of world resources and the economic collapse if we are not attentive to the ecological footprint of humanity and carrying capacity of the earth.

India is the first country to include Environmental Protection Act, 1986 as one of the fundamental duties of every citizen in its Constitution under Article 48A (Dalhstorm, 2010). India adopted various pro-environmental Acts only after 1970s. As it is recognized that developing countries would have to face 75-80 per cent damage from climate change, it is imperative that a transformation of the world's energy system takes place.

3.5 Renewable Energy Technologies (RETs)

Renewable Energy (RE) is the reformation of natural energy through sophisticated technologies as a substitute for the conventional energy. The idea of green economy visualizes an environment-friendly, green way of producing energy. Distressing intensification of conventional energy prices, rise in imports and growth in the GHG emissions clearly point towards the need for greening the energy sector.

COP 21 in Paris in December.2015 is the recently held initiative by Indian government for developing low carbon economy by promoting global partnership of renewable (solar) abundant countries. As a result of this more than150 countries have submitted their Intended Nationally Determined Contribution (INDC) for COP 21 agreement that would prevent hazardous emissions with the climate system**.**

Life cycle emission analysis of various sources of electricity generation shows a range between 10g/kwh to 900g/kwh. However the whole life cycle emission of each renewable technology ranges from 10-30g/kwh (Sahini, 1995). RE would also help in significant reduction of foreign exchange usage for the import of fossil fuels which would have a significant effect on a country's Balance of Payment (BoP) and foreign exchange reserves. Normally RETs treated as "sustainable" because it doesn't lead to an irreversible damage to the earth's eco system. European commission's 20/20/20 goals and mission 2020 of India also throw light in to the need of renewable in the energy mix. The UN General Assembly has vowed to double the share of RETs from 18 per cent in 2010 to 36 per cent in 2030.

3.6 Types of RETs

Solar Energy: It's the energy received from the radiation of the sun.

Wind Energy: Wind turbines/wind mills are used to convert wind into electricity.

Hydro Energy: It is the energy derived from the movement of water. It is imperative to note that only small hydro energy projects are considered as environment friendly.

Ocean energy: Including wave, tidal and ocean current power.

Geothermal Energy: Geothermal energy is used in two ways: either heat from the earth is used directly in industrial processes or to heat buildings, or indirectly by driving turbines to generate electricity.

Bio energy: The term bio energy refers to energy derived from any organic matter that is available on a renewable basis.

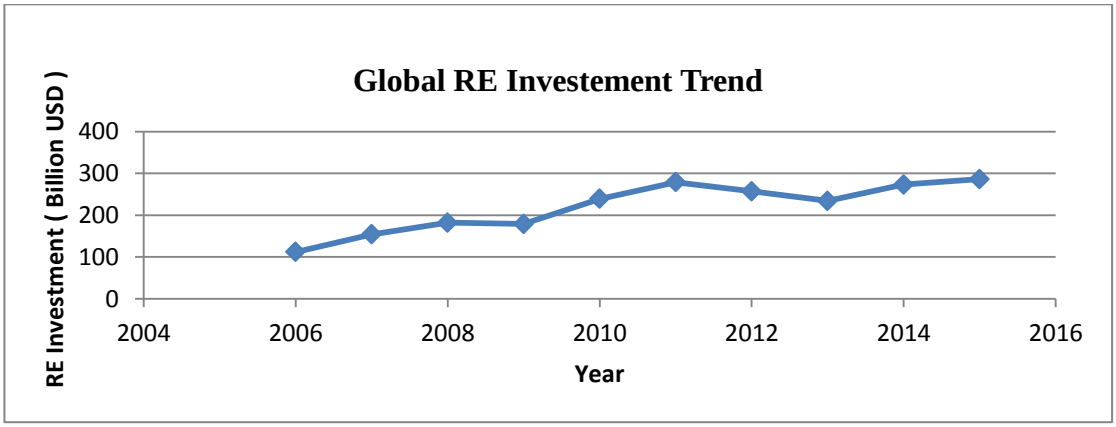
Table No: 3. 3
RE Capacity

Countries	RE capacity (In GW)	Per cent Share
China	199	25.35
US	122	15.54
Germany	92	11.71
Japan	43	5.47
India	36	4.58
Italy	33	4.20
Spain	32	4.07

Source: REN 21, 2016

As per REN, 2016, total RE capacity of the world reached 785 GW (excluding hydro) of which China dominated with 25 per cent followed by US, Germany, Japan and India comes fifth position.

Figure No. 3.1
Global RE Investment Trends

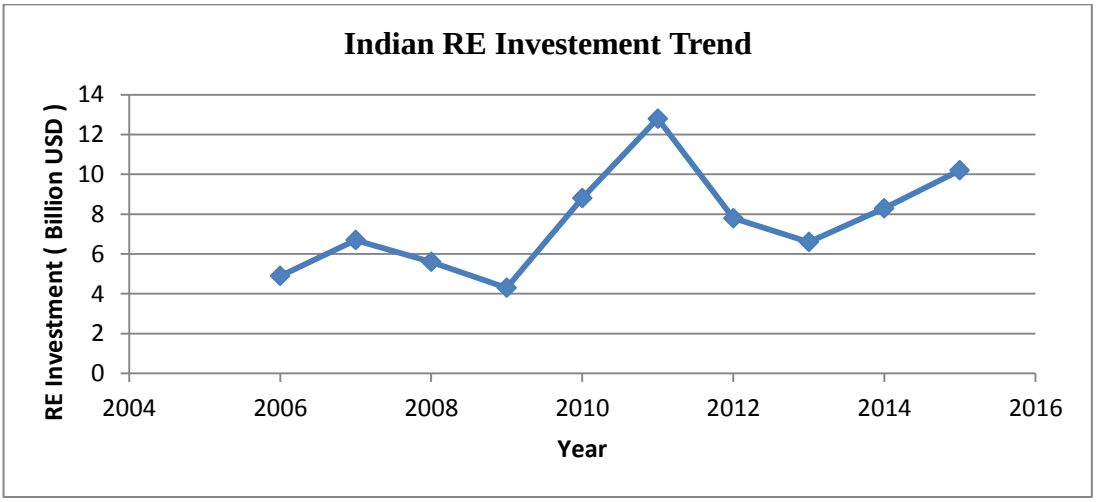


Source: REN 21, 2016

Chart shows the details regarding global level RE investment (not including hydro projects >50 MW) with an AGR of 12 per cent and CAGR of 10.98 percent

with an absolute figure of 112 Billion USD in 2006 to 286 Billion USD in 2015. The global RE investment has grown significantly and a rise seen during the year 2010-11 may be due to UNFCCC agreement and followed an increasing trend in 2014-15.

Figure No. 3.2
Trend in Indian RE Investment



Source: REN 21, 2016

At the same time in India, the investment (not including hydro projects >50 MW) shows a fluctuating trend with an AGR of 16 per cent and a CAGR of 8.49 per cent with an absolute figure of 4.9 Billion USD in 2006 to 10.2 Billion USD in 2015-16. The Indian RE investment has grown significantly and a rise can be observed during the year 2010-11 which can be attributed to the JNNSM in India.

Table No: 3. 4
Top 10 Investing Countries in Renewable Power (Billion USD)

Countries	Investment	Percent Share
China	102.9	42.31
USA	44.1	18.3
Japan	36.2	14.88
UK	22.2	9.12
India	10.2	4.19
Germany	8.5	3.49
Brazil	7.1	2.91
South Africa	4.6	1.89
Mexico	4.0	1.64
Chile	3.4	1.39

Source: UNEP, Bloomberg New Energy Finance (2015)

Majority of the global level RE investment is contributed by China. Similarly, it can be observed that developing countries are coming forward in RE investment instead of developed countries. India stands in fifth position in global level RE investment.

3.7 Indian Energy Scenario:-

India became the 4th largest energy consumer in 2014 from 7th in 2000. The cost of environmental damage has been estimated at approximately $32 billion as per figures identified by the National Productivity Council of India But at the same time, on per capita basis, India's carbon emission was much lower than most developed countries. (Akshay urja-dec-2015). As per the WHO survey, 13 of the most polluted cities across the G20 economies are in India.

Table No. 3.5

RE share in India's Installed Electricity Capacity (in MW)

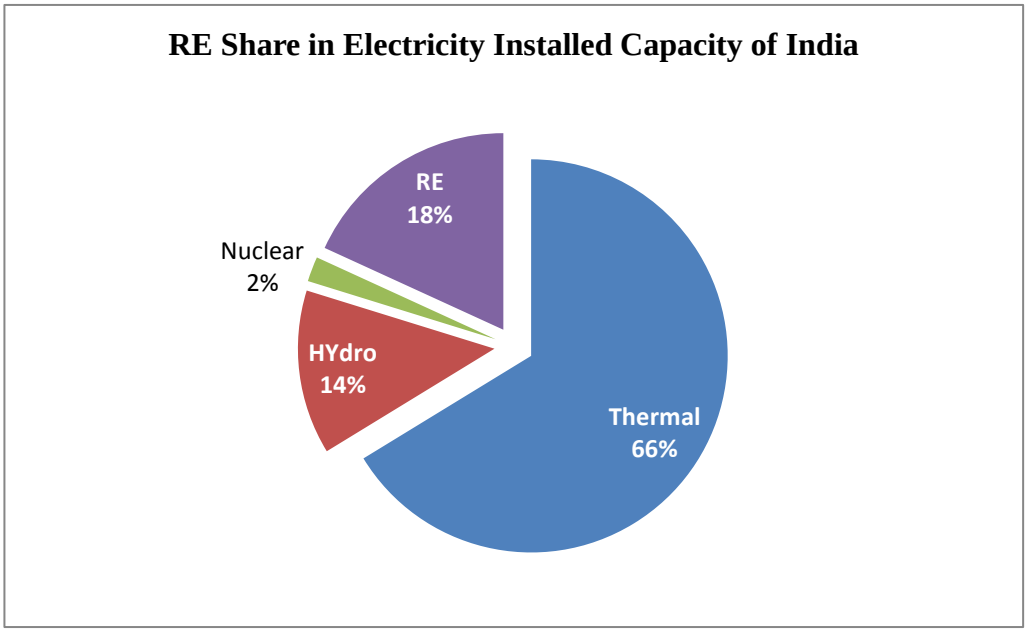
	2010-11	%	2011-12	%	2012-13	%	2013-14	%	2014-15	%	2015-16	%
Total Installed Capacity	1,67,077.36	100	173626.40	100	2,12,829	100	2,45,268	100	2,78,734	100	3,14,517	100
Thermal	1,08,362.98	64.6	1,12,824.48	64.98	1,41,713	66.58	1,68,255	68.60	1,94,200	69.6	2,15,169	68.41
Hydro	37,367.40	24.7	37,567.40	21.64	39,416	18.52	40,533	16.53	42,283	15.17	43,140	13.72
Nuclear	4,560	2.9	4,780	2.75	4,780	2.25	4,780	1.95	5,780	2.07	5,780	1.84
RE	16,786.98	7.8	18,454.52	10.63	26,920	12.65	31,702	12.92	36,471	13.08	50,068	15.92

Source: Complied from Economic Review and MNRE Annual Reports of Different Year

Table 3.5 depicts the growth in the energy sector in India from 2010-11 to 2015-16. Overall installed capacity in the country increased from 1,67,077.36 MW during 2010-11 to 3,14,517 MW during 2015-16 with an AGR of 13.34 and a CAGR of 13.48. It can be seen from the table that RE recorded a high per cent growth contributing 15.92 per cent during 2015-16 when compared with other sources. The contribution of RE in the total energy mix increased from 16786.98 MW during 2010-11 to 50068 MW in 2015-16 with an AGR of 25.18 and a CAGR of 24.42. Thermal contribution shows an increasing trend, viz. 108362.98 MW during 2010-11 to 215169 MW in 2015-16 with an AGR of 14.93 per cent and a CAGR of 14.70 per cent. Even though the CAGR shows a decreasing trend, the thermal contribution still accounts for

68.4 percent during the 2015-16, while hydro and nuclear show a decreasing trend. Hydro contribution decreased from 37367.40 MW in the total energy mix during 2010-11 to 43140 MW with an AGR of 2.93 per cent and a CAGR of 2.91 per cent. Nuclear also shows a decreasing trend, viz. 4560 MW during 2010-11 to 5780 MW in 2015-16 with an AGR of 5.15 per cent and a CAGR of 4.85 per cent. We need to inject more RE in order to reduce the share of non-conventional energy sources.

As per CEA, Power Ministry of India records, total Installed Capacity was 331,118 MW as on 31.10.2017. Out of this, 66.3% is contributed by thermal with an absolute figure of 219415 MW, 13.5 per cent is contributed by Hydro with an absolute figure of 44,765 MW, 2.1 per cent with an absolute figure of 6780MW contributed by nuclear and 18.2 per cent with an absolute figure of 60158 MW from RES.



Source: CEA as on 31/10/2017

Figure 3.3

Source Wise Power Installed Capacity as on 31/12/2016

Table No. 3.6

State wise Renewable Energy Potential (in MW)

Sl. No.	States/UTs	Wind Power	States/UTs	Small Hydro Power	States/UTs	Bio – Energy	States/UTs	Solar	States/UTs	Total
1	Gujarat	35071	Karnataka	4141	Punjab	3517	Rajasthan	142310	Rajasthan	148518
2	Andhra Pradesh	14497	Himachal Pradesh	2398	Maharashtra	3424	Jammu & Kashmir	111050	Jammu & Kashmir	118208
3	Tamil Nadu	14152	Uttarakhand	1708	Uttar Pradesh	3043	Maharashtra	64320	Maharashtra	74500
4	Karnataka	13593	Jammu & Kashmir	1431	Haryana	1707	Madhya Pradesh	61660	Gujarat	72726
5	Maharashtra	5961	Arunachal Pradesh	1341	Gujarat	1683	Andhra Pradesh	38440	Madhya Pradesh	66853
6	Jammu & Kashmir	5685	Chhatisgarh	1107	Tamil Nadu	1671	Gujarat	35770	Andhra Pradesh	54916
7	Rajasthan	5050	Andhra Pradesh	978	Karnataka	1581	Himachal Pradesh	33840	Karnataka	44015
8	Madhya Pradesh	2931	Madhya Pradesh	820	Madhya Pradesh	1442	Orissa	25780	Himachal Pradesh	36446
9	Orissa	1384	Maharashtra	794	Rajasthan	1101	Karnataka	24700	Tamil Nadu	34152
10	Uttar Pradesh	1260	Kerala	704	Kerala	1080	Uttar Pradesh	22830	Orissa	27728

11	Kerala	837	Tamil Nadu	660	Others	1022	Telangana	20410	Uttar Pradesh	27593
12	Uttarakhand	534	Uttar Pradesh	461	Andhra Pradesh	1001	Chhatisgarh	18270	Telangana	20410
13	Andaman & Nicobar	365	Punjab	441	Bihar	992	Jharkhand	18180	Chhatisgarh	19951
14	Chhatisgarh	314	West Bengal	396	West Bengal	544	Tamil Nadu	17670	Uttarakhand	19071
15	Arunachal Pradesh	236	Orissa	295	Orissa	268	Uttarakhand	16800	Jharkhand	18580
16	Bihar	144	Sikkim	267	Chhatisgarh	260	Assam	13760	Assam	14330
17	Puducherry	120	Assam	239	Assam	220	Bihar	11200	Bihar	12559
18	Assam	112	Meghalaya	230	Himachal Pradesh	144	Manipur	10630	Manipur	10811
19	Sikkim	98	Bihar	223	Delhi	131	Mizoram	9090	Arunachal Pradesh	10236
20	Haryana	93	Jharkhand	209	Jharkhand	100	Arunachal Pradesh	8650	Mizoram	9261
21	Jharkhand	91	Gujarat	202	Jammu & Kashmir	43	Nagaland	7290	Kerala	8732
22	Meghalaya	82	Nagaland	197	Uttarakhand	29	West Bengal	6260	Nagaland	7513
23	Himachal Pradesh	64	Mizoram	169	Goa	26	Kerala	6110	West Bengal	7222
24	Manipur	56	Haryana	110	Manipur	15	Meghalaya	5860	Punjab	6768

25	West Bengal	22	Manipur	109	Meghalaya	13	Sikkim	4940	Haryana	6470
26	Nagaland	16	Rajasthan	57	Nagaland	10	Haryana	4560	Meghalaya	6185
27	Daman & Diu	4	Tripura	47	Arunachal Pradesh	8	Punjab	2810	Sikkim	5307
28	Goa		Andaman & Nicobar	8	Chandigarh	6	Tripura	2080	Delhi	2181
29	Mizoram		Goa	7	Tripura	5	Delhi	2050	Tripura	2131
30	Punjab		Telangana		Mizoram	3	Goa	880	Others	1812
31	Telangana		Chandigarh		Puducherry	3	Others	790	Goa	912
32	Tripura		Dadar & Nagar Haveli		Sikkim	2	Andaman & Nicobar	0	Andaman & Nicobar	373
33	Chandigarh		Daman & Diu		Telangana	0	Chandigarh	0	Puducherry	123
34	Dadar & Nagar Haveli		Delhi		Andaman & Nicobar	0	Dadar & Nagar Haveli	0	Chandigarh	6
35	Delhi		Lakshwadeep		Dadar & Nagar Haveli	0	Daman & Diu	0	Daman & Diu	4
36	Lakshwadeep		Puducherry		Daman & Diu	0	Lakshwadeep	0	Dadar & Nagar Haveli	0
37	Others		Others		Lakshwadeep	0	Puducherry	0	Lakshwadeep	0
	Total	**102772**	**Total**	**19749**	**Total**	**25094**	**Total**	**748990**	**Total**	**896602**

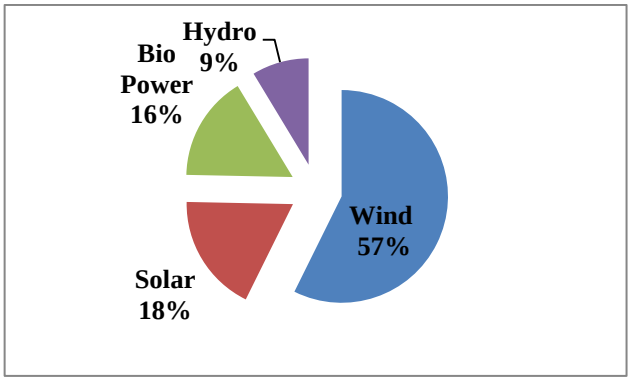
Source: MNRE

It is noted that out of the total Indian RE potential 896602 MW, solar energy potential accounted for 83 per cent with an absolute figure of 748990 MW followed by wind energy potential with 11 percent contributing 102772 MW, bio-energy with 2.7 per cent contributing 29090 MW and small hydro potential with 2.2 contributing 19749M

As far as solar energy potential is concerned, Rajasthan accounts for 142310 MW contributing 19 per cent, Jammu & Kashmir 111050 MW contributing 14.8 per cent, Maharashtra 64320 MW, contributing 8.58 per cent, Madhya Pradesh with 61660 MWcontributing 8.2 per cent, and Andre Pradesh 38440 MW contributing 5.13 per cent.

Kerala stands in the 21st position in RE potential with an absolute figure of 8732 MW, 11th position in wind potential with an absolute figure of 837 MW, 10th position in hydro potential with an absolute figure of 704 MW and 10th position in biomass potential with an absolute figure of 1080 MW which contributes 0.97 per cent, 0.8 per cent, 3.5 per cent, and 4.3 per cent respectively to overall RE, wind, hydro and biomass potential across India.

Kerala stands in 23rd position in solar energy with 6110 MW potential while 21st position in total RE potential with 8732 MW. It is important to note that out of the total RE potential, around 70 per cent is from solar energy. Solar installed capacity of Kerala currently reached around 90 MW which is only 1.47 per cent of the state's solar potential.



Source: MNRE (2016)

Figure No. 3.4
Source wise RE contribution

Wind energy continues to dominate India's renewable energy industry, accounting for over 57.4 per cent of installed capacity (28,700 MW), followed by solar power (9,013 MW), bio power (8,021 MW) and small hydropower (4,334 MW). Cumulative deployment of Off-Grid SPV systems as on 31st December, 2016 was 405.54 MWEQ.

Table 3.7

Comparison of Electricity Generation Process: Fossil Fuels and Renewable Energy

Technology	Process
PV	PV Installation- Distribution
Wind	Wind farm - National Grid - Distribution
Biomass	Planting – Harvest- Shipping – Processing –Shipping – Power stations-National grid-Distribution
Coal	Mining- Refining-Shipping-Coal fired power station – Disposal of Ash-National grid high Voltage - National grid medium Voltage - Distribution low Voltage

Source:(Hermann Scheer,2002,p.79)

Section 2

Solar Energy

3.8 An Overview of Solar Energy Scenario

The significance of solar energy has been recognized since ancient times by Indians, Egyptians, Greeks, Romans, Asteks and Mayans of North America and insome places the Sun is worshipped as deity. The Sun is given a prominent place in a number of religions. Our present energy sources, viz. coal and petroleum also represent the stored energy of the Sun and more interestingly renewable powers, like wind, hydro are the indirect forms of solar energy.

Solar energy is obtained in the form of radiation or electromagnetic radiations. It has been calculated that a single day's solar energy falling on the earth surface is sufficient to meet the entire energy needs of the globe for 15 years. In fact, the amount of solar power entering the Earth atmosphere is 17^{17} watt, but only 10^{16} watt is available. And the world energy requirement is 10^{13} watt. If 1 per cent of solar power will be harnessed it will be 10 times more than our requirement (UNFCC-1992, Rio Summit). Every year, the Sun delivers 15000 times more energy than is consumed by the entire human population (Scheer, 2002). Harvesting and conversion of this precious energy source according to our needs is now possible through technologies and becoming economical to different categories of consumers in various countries.

Historically, it is believed that solar energy has been used in 214 BC by a Greek scientist Archemedes to set fire to a Roman fleet and it is believed that it was the first large scale application of solar energy. It has a proven track record in the international space programme and space industry which ensures reliability of technology.

Solar energy is the familiar and most suited form of decentralized use of energy and can be used for off-grid installations. A 100 KW rooftop solar unit can save 3000 tonnes of co2 over its 25 year life time (Energy next-2016). The solar programme of the government was run by the MNRE and India was then and still remains the only country with the full fledged ministry for RE. (Millar, D. 2009)

3.9 Applications of solar energy

Solar radiation varies in intensity depending on the latitude, season of the year, and time of the day. Solar energy application can be subdivided into several groups. Generally solar energy can be utilized in two ways, namely.

Passive way i.e. maximizing the use of day light through building design which was used by ancient civilization and not aiming at the conversion of heat and light into other forms.

Active means harnessing of solar energy through devices and equipment to store it or convert it and can be divided into PV and thermal.

Technically, solar energy can be divided into two major technologies.

Table No. 3.8

Solar Energy Applications

	Grid	**Off-grid**
Thermal	Concentrated solar techno-logies, such as parabolic through, parabolic dish	Solar water heater Solar cooker, dryers, Thermal air conditioning
PV	Grid interactive Solar PV system	Solar signals Street lighting Water pumping system

a) Thermal route: solar thermal technology relies on capturing heat from the Sun. This heat is used directly or converted into mechanical energy and in turn into electricity. It is used for heating applications or electricity generation. It can be divided into solar thermal non electric (agricultural drying, SWHs, solar air heaters, solar cooking system) and solar thermal electric (CSP) which uses solar heat to produce steam for electricity generation. Four types of CSP are Parabolic Trough, Fresnel Mirror, Power Tower, Solar Dish collector.

b) Photovoltaic Route

Photovoltaic can be used in a wide range of applications from small consumer items to large commercial solar electric systems. The photovoltaic technology allows the direct transformation of the energy associated with solar energy into electrical energy, i.e. which directly converts sunlight into electricity using panels made of semiconductor cells.

Table No. 3.9

Solar Energy Applications coming under PV and Thermal Technology

Solar PV Applications	Solar Thermal Applications
Solar lantern	Solar water heater
Solar home lighting system	Solar cooker
Solar Street Light	Solar dryer
Pumping of irrigation water	Solar heating and cooling of building
Community lighting system	Space heating
Applications for remote locations	Space cooling
Can Power railways, armed forces, and telecommunications	Solar Refrigeration
	To produce fresh water from salt water (Distillation)

3.10 Basic insights in to SPV technology

Photovoltaic consists of two words "photo" means light and "Volta" is the unit of electrical voltage (Volker Quashing, 2006). Solar Photo voltaic technology enables the direct conversion of solar energy into electricity. This technology is easily scaled to suit energy needs of any size from powering calculators to onsite generation for residential, commercial and industrial users. Even though it is believed that the first use of concentrated solar energy was done by Archemedes, the electricity generation capacity from solar energy was realized only in 1839 when "photovoltaic effect" discovered by Einstein for which he received the Nobel Prize. And it remained a

“laboratory curiosity” due to its high initial cost and low conversion efficiency which was a constraint for its commercialization. Introduction of crystalline silicon solar technologies, reduction in the cost, along with increase in efficiencies gradually lead to acceleration/penetration of this micro generation technology.

PV will account for 222 GW of global energy supply at the end of 2015 (IRENA). Earlier studies confirmed that the limiting factor for the deployment of PV is not resources. However, it remains as an infant technology primarily because of its high levelized cost of electricity and lack of market experience.

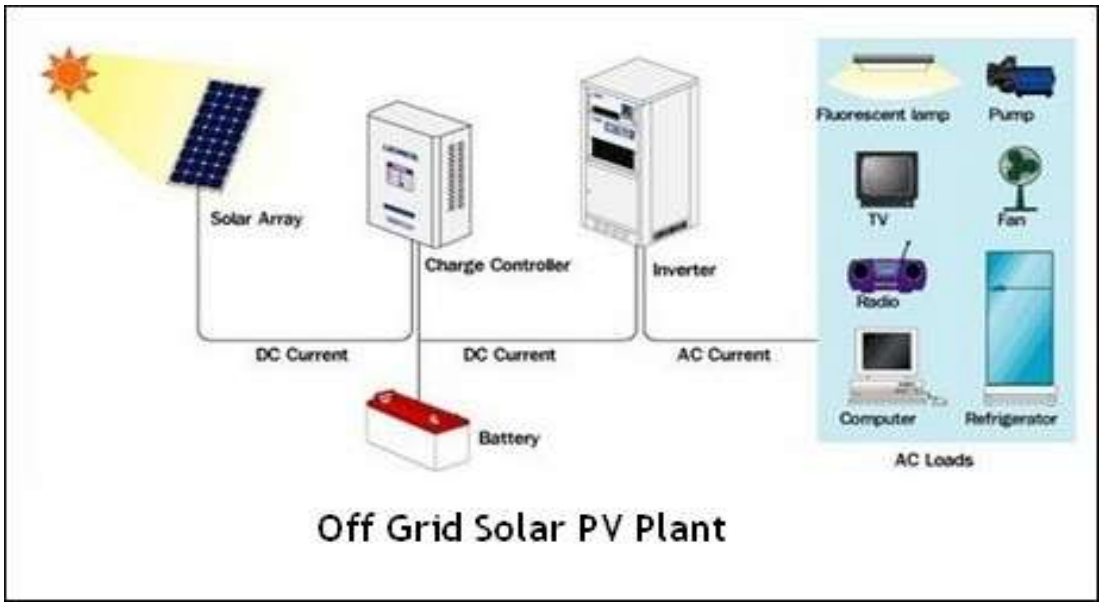
3.11 Off Grid RTPV

Solar PV can be divided into off-grid and on-grid systems. Among various solar photovoltaic technologies, solar photovoltaic off grid system is a decentralized application which does not require land, displacement, resettlement, or rehabilitation problems. This can be installed on the rooftop space available in residential, governmental, educational institutions, hospitals, hotels, and also commercial and industrial buildings. It could be installed on rooftop available on bus stands and railway stations also and can generate power and can store generated electricity. Off Grid PV is equipped with batteries for storage of energy which generated during day time and has no interaction with grid. So the system owner can store the energy from the sun during day which can be used in night time. On the other hand, On-Grid PV is connected to the grid for exporting the excess power produced by the consumer and can import the power if they need. Its working is based on net metering policy and the consumer benefits from a financial reimbursement.

The market penetration of these micro generation technology systems is still dominated by government programme. Approximately 1.5 million homes worldwide have these rooftop solar PVs feeding into the electric grid. Grid connected systems and these systems are more common in countries like Germany, Italy, Spain, France and Greece. Off-grid systems are found mostly in developing countries, like Sri Lanka, Vietnam, Nepal and India.

Table No. 3.10
Components of PV System

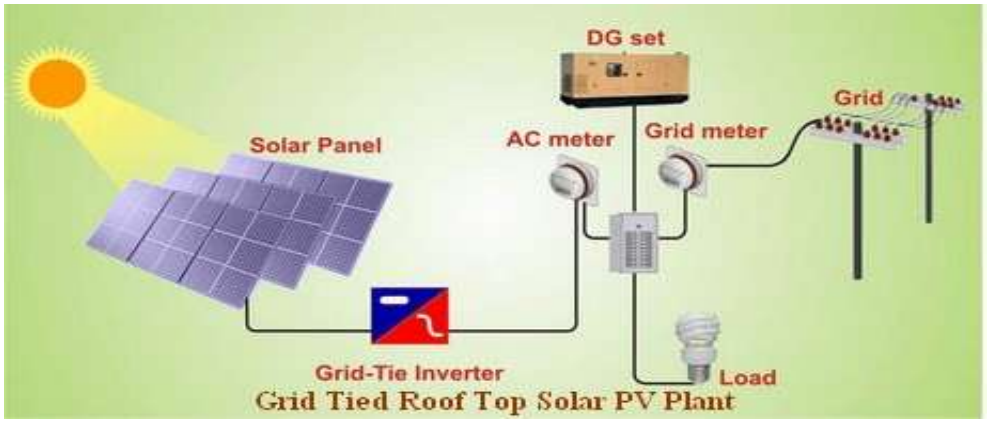
Solar Panels	Panels are the array of solar modules which are made up of cells. Solar cell converts solar energy into electrical energy
Inverter	Used to change direct current received from the Sun to alternative current
Battery	For storing the energy produced from the Sun
MPPT	Maximum Power Point Tracking-Charge controller
BoS	Balance of Systems (Includes cable,



Source: http://www.adsprojects.org/services-EPC-of-roof-top.html

Figure No. 3.5

Basic Layout of Off-grid SPV system



Source: http://www.adsprojects.org/services-EPC-of-roof-top.html

Figure No. 3.6

On-grid SPV System

On-grid can be connected to the electric grid. Here system owner can use plant generated electricity and if there is excess production, it can be exported to the grid at a retail price. On-grid system doesn't need battery for storage and it is used a bidirectional meter for measuring the exported and imported energy

Table No. 3.11

SWOT Analysis of Off-grid Solar Photovoltaic Power Plant Market Development

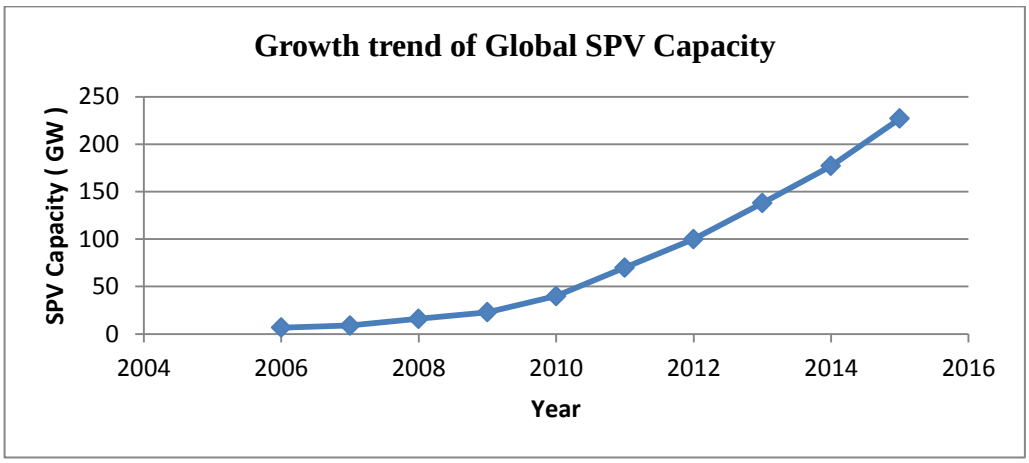
Strengths	Weaknesses
Direct conversion of sunlight into electricity	High Cost of the system
Ubiquitious (A.Goetzberger,2005)	Lack of Standardization
Evenly Distributed Source	Lack of Awareness among People about this Technology
No noise pollution	Low conversion efficiency
Need less maintenance	Cumbersome Procedures for getting subsidy
Help in reducing global warming and climate change issues	Lack of skilled workers
Inexhaustible	Inadequate Location

Its environment Friendly	High payback
Reduces Co2	Lack of mandatory implementation of Policies
Micro generation innovative green energy Product	Lack of promotional activities
Government Support	Lack of Maintenance
Eliminates transmission losses and distribution losses	Lack of output Monitoring
Reduces dependence on fossil fuel	Not efficient to all segments of customers especially low electricity tariff category
On -site generation of power	High import may lead to foreign exchange outflow
Utilizing unused rooftop space	
No requirement of additional land	
Local employment generation	**Threats**
Opportunities	Intermittency
Can meet wide range of power requirement ranging from microwatts to megawatts	Skepticism
Flexiblity	Non valuation of long term benefits
Decentralised usage	Non valuation of negative costs of conventional energy
Can add value to property	High price of modules
Government Initiatives included in solar energy policy of the state	Time lag in subsidy releasing
Increasing trend in the purchasing power of consumers	Shift in political Will

(Compiled from Review of Literature)

3.12 Global solar energy scenario:

As per Greenpeace, Netherlands 1999, it is observed that the world PV market could increase from 84 MW in 1995 to over 18000MW by 2020.



Source: IEA 2016

Figure No. 3.7

Growth trend of Global SPV Capacity

Chart showing information regarding the increasing trend of global SPV Installation which has reached about 227 GW in 2015 from 6.7 GW in 2006 with an AGR of 49.13 and with a CAGR of 47.90.

3.13 Top 10 countries for PV capacity installation

Globally solar PV capacity reached about 222 GW in the energy mix as in 2015. Table No: 3.16 provides information regarding the leading countries in PV capacity installation. India stands in the 7th position worldwide in PV capacity installations with 6.8 GW as in 2016.

Table No: 3.12

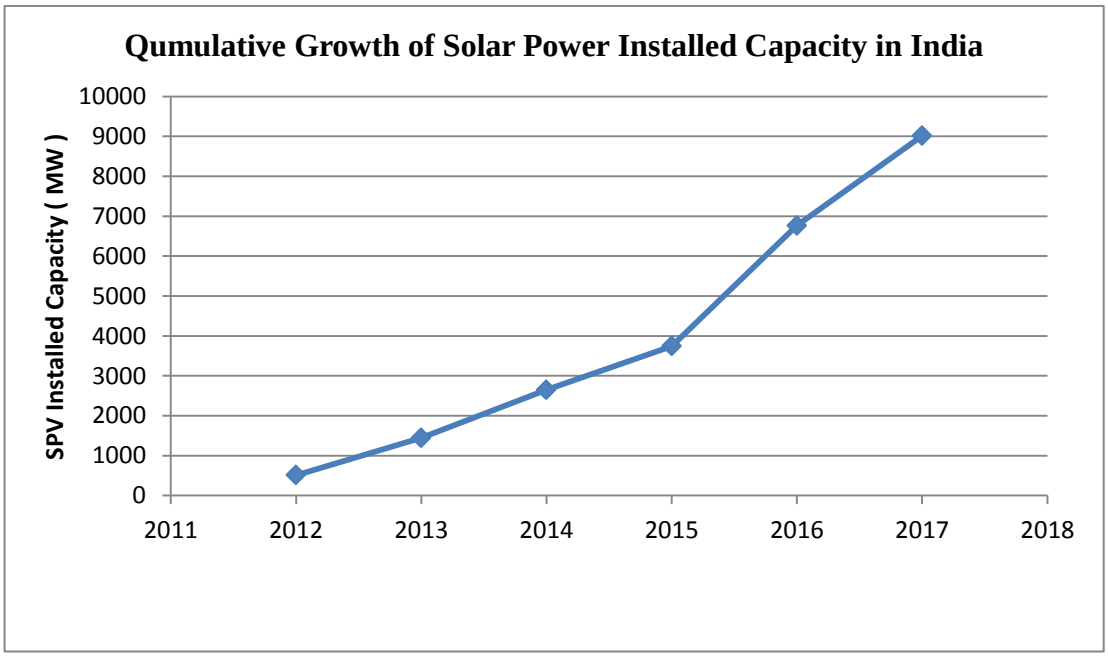
Top 10 countries for PV capacity installed in 2015 (in GW)

Country	Total Capacity	Capacity added in 2015
China	43.5	+ 15.2
Germany	39.7	+1.5
Japan	34.4	+11.0
USA	25.6	+7.3
Italy	18.9	+0.3
UK	8.8	+8.8
India	6.8	+3.0
France	6.6	+0.9
Spain	5.4	+0.1
Australia	5.1	+0.9

Source: REN, 2016

3.14 Overview of Current National SPV Scenario:

Solar energy experienced a phenomenal growth in recent years all over the world because of environmental concern, Government supportive measures and cost reduction. **(**Timilisha, et al., 2011)**.**



Source: MNRE

Figure No. 3.8

Qumulative Growth of Solar Power Installed Capacity in India

Chart shows information regarding the cumulative growth trend of SPV Installation in India which has reached about 9012.85 MW in 2015 from 513 MW in 2006 with an AGR of 84.5per cent and with a CAGR of 77.39 per cent.

3.15 Government Initiatives in Indian Solar Energy Sector

There are many national level institutions for promoting Renewable Energy (RE). MNRE established various national level institutions for promoting RE and Research and Development (R&D). India was one of the first countries to recognize the importance of promoting RE technologies and is also the pioneer in setting up a dedicated ministry for promoting RE.

India's solar market, especially solar PV, has seen significant growth after the launch of the JNNSM in 2010. India's solar energy initiatives on a large scale started with National Action Plan on Climate Change (NAPCC), under UNFCCC, IPCC on 30th June, 2008. Jawaharlal Nehru National Solar Mission (JNNSM), launched under NAPCC, aims to install 20 GWp of grid-connected PV systems and 2 GWp of off-grid systems including 20 million solar lights by the year 2022. Recently the Government of India has expressed its intent to achieve 100 GW of solar capacity in the country by 2020, of which 40 GW is expected to be achieved through decentralized and rooftop-scale solar projects. Rooftop solar PV has already achieved grid parity for commercial and industrial consumers and is becoming attractive for residential consumers. As a result, multiple state governments have taken efforts for the implementation of various rooftop programmes with various incentives. India has emerged as one of the most vibrant markets for solar energy.

In 2015, investments of $ 5.6 billion (around Rs. 38000 crores) to build solar energy generating capacity were announced, compared with $ 3.1 billion in 2014. INDC targets for India are more appreciable as the government increased its solar RE target 175 GW and 100 GW from solar only and further enhancement of 250 GW by 2030 .The renewable power target of 175 GW by 2022will result in abatement of 326.22 million tonnes of CO_2 equivalent/ year. Out of this, 40000 Mwp comes through grid connected roof top system and this 40GW will result in the abatement of about 60 million tonnes of CO_2 per year. (Akshay Urja, 2016). Doubling of cess from

Rs.200 to Rs. 400 on every tonne of coal, decision to set up a new pollution research institute, 33 solar parks in 21 cities, increase in the Plan outlay to support RE from Rs.2509 crore in 2015-16 and further to Rs.5000 crore in 2016-17 budget, launching of 'Surya Mitra' scheme, reduction in solar tariff of Rs.2.65 per Kwh in May-2017 are some of the welcome initiatives of the Government of India for solar energy penetration. Recently held International Solar Alliance COP 21climate conference in Paris aimed to achieve 30-35 per cent reduction in carbon intensity of GDP from 2005 levels by sourcing 20 per cent of renewable energy. Through Make in India initiative, the Government is planning to make a major global investment in the RE sector for making the country energy secure. As per the IEA, solar could be the world's largest source of electricity by 2050. Now the government is planning to introduce green corridors which will facilitate the uninterrupted transmission of GW's of energy from installation utility into grid as a welcome initiative for the growth of solar energy in India. Inclusion of RE in the Prime Sector Lending (PSL) activities by RBI in a notification on April 23, 2015 and RE-INVEST 2015 has also played a major role in securing investment by creating global partnership of solar abundant countries.

According to MNRE sources, it is possible to generate solar power from solar rooftop system at about Rs.6.50/ Kwh which is cheaper than the diesel generating sets based electricity generation (Energy next, 2016).

Table No. 3.13

Plan Wise Growth of RE power Generating Capacity

Sector	**Cumulative Capacity in MW**			
	Beginning of 10th Plan (April 2002)	**Beginning of 11th Plan (April 2007)**	**Beginning of 12th Plan (April 2012)**	**CAGR**
Wind	1628	7092	17352	226.47
Small Hydro	1434	1976	3395	53.86
Biopower	389	1184	3225	187.93
Solar	2	3	941	2069
Total	**3453**	**10255**	**24914**	**168.6**

Source: MNRE

While looking at table no: 3.13, a rapid development has been seen in the solar energy growth during the 12th Plan period.

Table No. 3.14

Reduction Trend in Solar Tariff

Solar Tariff	Per kWh	Per cent Change
AP (Oct.2014)	5.25	
MP (June 2015)	5.05	-3.8
AP (Nov.2015)	4.63	-8.32
Rajasthan	4.34	-6.26
Madhya Pradesh (REWA Solar park), February-2017	3.30	-24
Rajasthan (Bhadla IV Solar park), May-2017	2.62	-20.6
Rajasthan (Bhadla III Solar park), May-2017	2.44	-6.87

Source: Compiled from Energy Next, 2016 and 2017

It is observed that solar tariff has touched the lowest viz., 2.44 during an auction held at Rajasthan. It is noteworthy that 53.5 per cent decrease from 5.25 Per kWh in 2014 to 2.44 Per kWh in 2017.

3.16 Different supportive schemes for rooftop solar PV in India

There are different types of Support Mechanisms introduced by Government of India for promoting solar energy market**.**

Direct capital subsidy - Direct capital subsidy aimed at some reduction in the up-front cost of installed PV system cost.

Renewable Portfolio Standard (RPS) - Electricity utilities have the obligation to procure certain percentage of their electricity from renewable source.

Solar set aside RPS target - A mandatory obligation that a utility must use certain portion of their RE requirement from solar source only.

Tax credits - permission to deduct all expenses regarding the installation of solar power plant from taxable income.

Tax benefits - Accelerated depreciation allowed on investment in RE devices (excluding wind power plants).

Net metering -The system owner can consume electricity generated by solar system and if there is excess energy production, it can be feed into the grid and can receive retail value for the energy exported with the help of a bi-directional electricity meter.

Net billing - The system owner needs to pay only the net amount after adjusting the electricity taken from the grid and the electricity fed.

Sustainable building requirements-They include requirements on new building developments (residential and commercial).

Table No: 3.15

State-wise Estimated Solar Energy Potential vs. Installed Solar Capacity in the Country as on 31.12.2016

SOLAR POTENTIAL			INSTALLED SOLAR CAPACITY		
State/UT	Solar Potential (GWp)	Percent	State/UT	Installed Capacity (MW)	Percent
Rajasthan	142	18.93	Tamil Nadu	1590.97	17.65
Jammu &	111	14.8	Rajasthan	1317.64	14.61
Maharashtra	64	8.53	Gujarat	1158.5	12.85
Madhya	62	8.26	Andhra	979.65	10.86
Andhra	38	5.06	Telangana	973.41	10.8
Gujarat	36	4.8	Madhya	840.35	9.32
Himachal	34	4.53	Punjab	545.43	6.05
Odisha	26	3.46	Maharashtra	430.46	4.77
Karnataka	25	3.33	Karnataka	327.53	3.63
Uttar Pradesh	23	3.06	Uttar Pradesh	239.26	2.65
Telangana	20	2.66	Chhattisgarh	135.19	1.49
Tamil Nadu	18	2.4	Bihar	95.91	1.06
Chhattisgarh	18	2.4	UTs &	88.68	0.98
Jharkhand	18	2.4	Odisha	77.64	0.86
Uttarakhand	17	2.26	Haryana	53.27	0.59
Assam	14	1.86	Uttarakhand	45.1	0.5
Bihar	11	1.46	Delhi	38.78	0.43
Manipur	11	1.46	West Bengal	23.07	0.25
Arunachal	9	1.2	Jharkhand	17.51	0.19
Mizoram	9	1.2	Kerala	15.86	0.17
Nagaland	7	0.93	Assam	11.18	0.12
West Bengal	6	0.8	Tripura	5.02	0.05
Kerala	6	0.8	Jammu &	1	0.01

Meghalaya	6	0.8	Nagaland	0.5	0.005
Haryana	5	0.66	Himachal	0.33	0.003
Sikkim	5	0.66	Arunachal	0.27	0.002
Punjab	3	0.4	Mizoram	0.1	0.001
Delhi	2	0.26	Goa	0.05	0.0005
Tripura	2	0.26	Manipur	0.01	0.0001
UTs & Others	1	0.13	Meghalaya	0.01	0.0001
Goa	1	0.13	Sikkim	0.01	0.0001
TOTAL	**750**		**TOTAL**	**9012.69**	

Source: MNRE 2016

Kerala shows a solar PV potential of 6 GW contributing 0.8 per cent to overall national solar energy potential. While the installed capacity is 0.17 Per cent to the overall national installed capacity with an absolute figure 15.86 MW. Kerala stands in the 23rd position in solar energy potential while in the 20th position in installed capacity in India as in 2016.

There observed a mismatch when considering top 10 states in solar energy potential and installed capacity share. Some states occupy higher rank in solar energy installed capacity even though they are low rank-wise, when considering solar energy potential. So it can be inferred that higher per cent solar energy installation level doesn't depend on states potential.

Table No 3.16: State wise Cumulative Installation of SPV Systems as on 31-12-2016

	Lanterns (Nos)		**Home Lights Nos**		**Street Lights (Nos)**		**Pumps (Nos)**		**Stand Alone power plants (KWp)**
Others	125797	Uttar Pradesh	235909	Uttar Pradesh	185091	Rajasthan	37306	Chhattisgarh	27867.72
Uttarakhand	93927	Tamil Nadu	226946	Himachal Pradesh	58508	Uttar Pradesh	8958	Others	23885
Haryana	93853	Rajasthan	151964	Tamil Nadu	36802	Andhra Pradesh	8952	Kerala	13894.39
Maharashtra	68683	West Bengal	145332	Haryana	22018	Gujarat	7620	Gujarat	13576.6
Tripura	64282	NABARD	108000	Uttarakhand	21905	Odisha	6673	Tamil Nadu	12752.6
Uttar Pradesh	62015	Uttarakhand	91595	Punjab	21758	Chhattisgarh	5388	Rajasthan	10850
Kerala	54367	Jammu & Kashmir	65319	Maharashtra	10420	Tamil Nadu	4763	Uttar Pradesh	10041.46
Andhra Pradesh	51360	Haryana	56727	Madhya Pradesh	9378	Madhya Pradesh	3813	Jammu & Kashmir	7719.85
Jammu & Kashmir	51224	Karnataka	49644	Others	9150	Karnataka	3200	Telangana	5368
Bihar	50117	Kerala	40412	West Bengal	8726	Jharkhand	2901	Karnataka	4676.41
Himachal Pradesh	33909	Tripura	32723	Andhra Pradesh	7812	Bihar	2882	Bihar	3968.6
Gujarat	31603	Others	24047	Rajasthan	6852	Punjab	1857	Maharashtra	3857.7

Meghalaya	24875	Andhra Pradesh	22972	Nagaland	6235	NABARD	1744	Andhra Pradesh	3785.595
Jharkhand	23374	Himachal Pradesh	22592	Odisha	5834	Maharashtra	1503	Madhya Pradesh	3654
Sikkim	23300	Arunachal Pradesh	18945	Jammu & Kashmir	5806	Kerala	810	Jharkhand	3539.9
West Bengal	17662	Sikkim	15059	Mizoram	5056	West Bengal	653	Haryana	2321.25
Punjab	17495	Bihar	12303	Karnataka	2694	Haryana	543	Lakshadweep	2190
Tamil Nadu	16818	Jharkhand	9450	Chhattisgarh	2042	Telangana	424	Punjab	1950
Arunachal Pradesh	14433	Gujarat	9253	Gujarat	2004	Tripura	151	West Bengal	1730
Odisha	9882	Punjab	8626	Manipur	1888	Goa	90	Mizoram	1719
Mizoram	9589	Meghalaya	7844	Kerala	1735	Assam	45	Assam	1605
Madhya Pradesh	9444	Chhattisgarh	7754	Lakshadweep	1725	Manipur	40	Uttarakhand	1534.03
Karnataka	7334	Mizoram	6801	Arunachal Pradesh	1671	Jammu & Kashmir	39	Nagaland	1506
Assam	6926	Odisha	5274	Meghalaya	1273	Mizoram	37	Himachal Pradesh	1390.5
Nagaland	6766	Madhya Pradesh	4016	Tripura	1199	Uttarakhand	26	Goa	1269
Andaman & Nicobar	6296	Manipur	3900	Bihar	955	Arunachal Pradesh	22	Manipur	1241
Lakshadweep	5289	Maharashtra	3497	Chandigarh	898	Puducherry	21	Meghalaya	884.5

Goa	4807	Assam	1121	Jharkhand	620	Meghalaya	19	Sikkim	850
Manipur	4787	Nagaland	1045	Sikkim	504	Chandigarh	12	Chandigarh	730
Rajasthan	4716	Andaman & Nicobar	468	Puducherry	417	Himachal Pradesh	6	Tripura	612
Chhattisgarh	3311	Chandigarh	275	Andaman & Nicobar	390	Andaman & Nicobar	5	Arunachal Pradesh	600.1
Chandigarh	1675	Puducherry	25	Assam	318	Nagaland	3	Odisha	567.515
Puducherry	1637	Goa	0	Goa	301	Sikkim	0	Andaman & Nicobar	167
Telangana	0	Telangana	0	Telangana	244	Lakshadweep	0	Puducherry	121
NABARD	0	Lakshadweep	0	NABARD	0	Others	0	NABARD	0

Source : MNRE

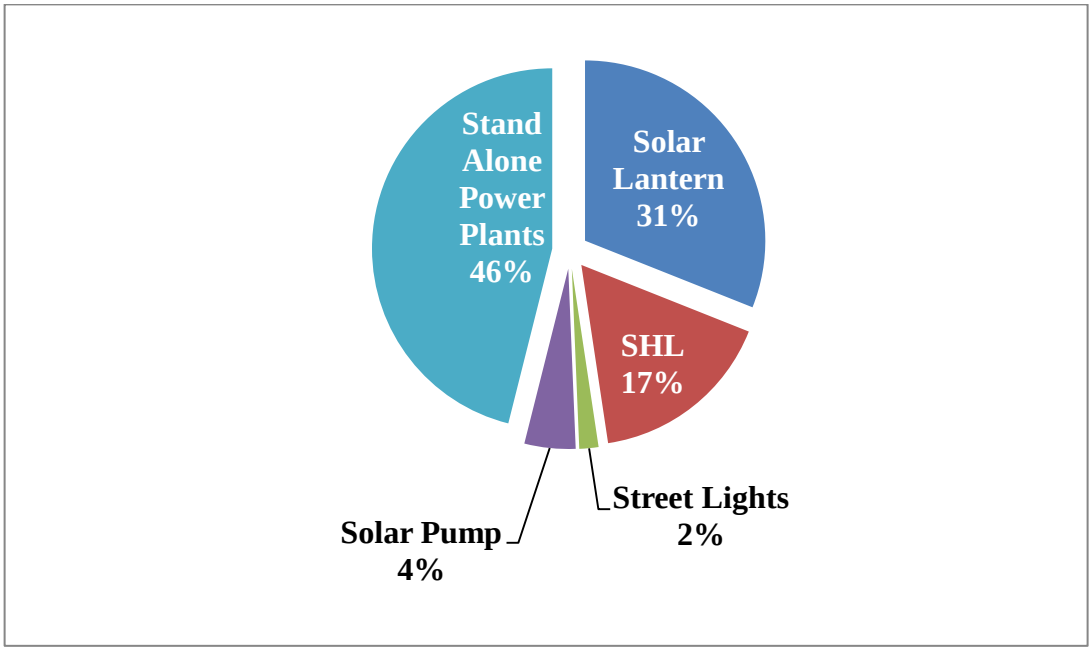


Figure No.3.9

Cumulative Installation of SPV Products in Kerala

While looking at the scenario, Kerala stands in the 7th position among Indian states with 54367 solar lantern distribution, 10th position with 4042 solar home lights distribution, occupies 21st rank with 1735 solar street light installations, 15th with 810 solar pump distribution and third in standalone power plant installation with 13894 KWp up to 2016.

Section 3

Kerala Solar Energy Scenario

3.17 Introduction

Kerala with an area of 38,863 km^2, accommodates 3,34,06,061 (31.84 million) population according to 2001 census. Out of this 48 per cent male and 52 per cent female living in around 7 million households. Average household size is 4.7. Kerala has a growth rate of 6.49 per cent in 2013 which was above the national average (4.04). Kerala being highest in many developmental indicators. Kerala was already recorded a high Human Development index (HDI) in India and its Global Hunger

Index is rated as 'serious' which is a better grade than 'alarming' received by many Indian states. Kerala also remains highest in literacy rate, life expectancy, and Gender equality and lowest in infant mortality, school dropout rate and low population growth. (Kerala Development Report, Planning Commission). According to NSSO report, Kerala recorded the top position in per capita monthly consumer expenditure both in the rural and urban sectors of the society

The study conducted by KSSP concluded that there is high level of income disparities existing in Kerala. The study states that 41 per cent of the total domestic income generated in the state is possessed by around 10 per cent of the population. The bottom 10 per cent get only a share of 1.3 per cent. The study also pointed out that 41 per cent of the Kerala population comprises the lower middle class and 9 per cent belong to upper middle class and the rich, i.e. approximately (10 per cent of 3,34,06,061) 3340606.1 . The study also indicated that the per capita monthly income of the upper middle class and the rich is 12 times more than the income of the poor. But the major problem lies in the field of energy security, employment generation and food production. Energy is the key driver of all types of development, whether it is of economic and social, environmental and technological and cultural.

3.18 Climate change effects in Kerala

Changing climate condition is a clear indication that it is gradually capturing Kerala. There is a significant deviation in the long term average of highest and lowest temperature during the day and there is a 5 per cent reduction in the long term average of availability of rain. According to the 'state level climate change trends in India-2013' report for 1951-2010, Kerala temperature is on a rising trend each year by 0.01^0c. Kerala topped the heat index by crossing temperature 51^0 C during March 2016. It is observed that per year water availability of Kerala is less than that of Rajasthan and per capita availability is also declining. All these clearly indicate the changing conditions of Kerala and point towards a development without sustainability. Presently, urbanization and industrialization would become the sign of development in the mindset of people. A green growth without affecting its

environment is necessary to fulfill the responsibility to handover the natural capital to the next generation.

3.19 Kerala Energy Scenario:

KSEB is the main authority for power generation and distribution in Kerala. Besides KSEB, there are agencies for the promotion of non conventional energy sources which are mainly ANERT, EMC, State Electricity Regulatory Commission (SERC), Electrical Inspectorate and they are also playing major roles in Kerala energy scenario. In Kerala, shortage of power is the prime obstacle in starting new industrial units. Demand supply gap, hydel power dominated supply scenario, negligible share of renewable energy in the energy mix, gap between energy conservation potential and its realization are the main challenges faced by the energy sector in the State (State Planning Board, Kerala. Economic Review 2011.Thiruvananthapuram, Kerala.).

Electricity needs would increase as a result of rise in population, urbanization and standard of living. The share of urban population in Kerala increased from 25.96 percent in 2001 to 47.72 percent in 2011 while it is 25.52 percent in 2001 and 31.16 percent in 2011 for India. Kerala was ranked as 9^{th} in terms of urbanization in 2011 at national level which was 19^{th} in 2001. During March 2016, the electricity usage of the state was recorded as 78.62 MU (7.66 crore unit). Even though the state is claiming about 100 per cent electrification, during this time, hydel sources had produced only 23.65 MU in Kerala and balance 51.77 MU was purchased from outer sources. Kerala has to borrow electricity daily by around 5.3 crore units from Central pools, (Chattisgarh, Orissa).

Table No: 3.17

Power Sector in Kerala

	2010-11	%	2011-12	%	2012-13	%	2013-14	%	2014-15	%	2015-16	%
Total Installed Capacity	2857.59	100	2872.79	100	2881	100	2892	100	2836	100	2880.20	100
Thermal	873.11	30.55	793	27.60	793	27.52	795	27.48	719	25.35	718.4	24.94
Hydro	2040.8	71.4	2045	71.1	2053	71.2	2054	71.02	2082	73.41	2104.3	73.05
RE	2040.8	71.4	2045	71.1	2053	71.2	2054	71.02	2082	73.41	2104.3	73.05

Source: State Planning Board 2017

The growth in the energy sector in Kerala from 2010-11 to 2015-16 is depicted in the table No: 3.17 Overall installed capacity in the state increased from 2857.59 MW during 2010-11 to 2880.20 MW during 2015-16 with an AGR of 0.16 per cent and CAGR of 0.157 per cent. It can be seen from the table that RE contribution to the total energy mix recorded an increase from 33.68 MW (1.17 per cent) in 2010-11 to 57.4 MW contributing 2 percent during 2015-16 with an AGR of 13.62 per cent and CAGR of 11.25 per cent. It can be clearly seen from the table that the thermal contribution showed a decreasing trend, viz. 873.11 MW (30.55 per cent) during 2010-11 to 718 MW (24.94 per cent) in 2015-16 with an AGR of -3.17 per cent and CAGR of -3.82 per cent. Hydro also showed a slightly increasing trend, viz. from 2040.8 MW (71.4 per cent) in the total energy mix during 2010-11 to 2104.3 MW (73.05 per cent) during 2015-16 with an AGR of .62 per cent and CAGR of .614 per cent.

Even though the state has also been forced to purchase more power from central generating stations, it has been observed that the state's power requirements could not be met fully from hydel projects alone. (Parameswaran, 1990)

Table No. 3.18
Consumption of Electricity in Kerala

Year	Total Consumption of Electricity (MU)	Growth Rate (Percent)	Per Capita Consumption of Electricity (KWh)	Growth Rate (Percent)	Number of Domestic Consumers	Growth Rate (Percent)
2011-12	15981		478		8324961	
2012-13	16838	5.36	501	4.8	8573938	2.9
2013-14	17454	3.65	516	2.9	8788916	2.5
2014-15	18426	5.5	544	5.4	8987947	2
2015-16	19325	4.8	565	3.8	9124747	1.52

Source: Economic Review (State Planning Board)

There is an increase of domestic consumers to 9124747 in 2015-16 from 8987947 consumers during 2014-15 with 1.52 percent growth. The past trend of consumption indicates a very high growth in the demand for energy in the domestic sector. An increase isseen in per capita energy consumption which reached 565 KW in 2015-16 from 544 KW from 2014-15 with a growth rate of 4.87 percent.

3.20 PV Applications Operational in Kerala.

Solar rooftop projects are being implemented by State Nodal Agencies (SNA's), Solar Energy Corporation of India (SECI), Public Sector Undertakings (PSUs) NGOs, and Private sector Developers. Deployment of this system occurs in the following forms:

- Domestic (Decentralized form which is a micro generation on building rooftops usually of 1KW)
- Commercial
- Distributed Grid connected PV
- Centralized Grid (Large scale PV)

3.21 Potential for solar energy in Kerala

Before promoting the penetration of SPV in Kerala, it is imperative to note the potentiality of this system. The values of global solar irradiance (GHI) and DNI for each district of Kerala are reproduced by utilizing soft ware (METEONORM) by WISE 2013.The study shows the GHI daily average value in the state is 5.49 kwh/m^2/day, or an annual value of 2003 kwh/m^2/year. Similarly, the DNI daily average value is 4.49 kwh/m^2/day or an annual value of 1639 kwh/m^2/year. As a general principle, any site with GHI more than 1500 kwh/m^2/year is suitable for solar PV technology and this indicates that Kerala is highly suitable for developing solar PV systems. At the same time, the resource values do not support suitability of solar thermal power generation because the average DNI is significantly less than the threshold value of 1800 kwh/m^2/year required for such projects. (The Energy Report - Kerala, WWF & WISE 2013). As a contradiction, thermal solar installations are more familiar in Kerala.

Table No 3.19

Decentralized Rooftop PV power Potential in Kerala (MW)

Households		
Rural	6128	13079
Urban	6952	
Institutional and Commercial Establishments		
Shop/Office	964	18066
School/College	6038	
Hotel/Lodge/guest houses	788	
Hospital/ Dispensary	1106	
Factory/ Workshop/ Workshed	6636	
Place of Worship	2533	
Total	**31145**	

WISE 2013

Table No 3.19 shows the assessment indicating the total exploitable potential for decentralized solar PV power packs for household sector is about 13079 MW, while that for Institutional or commercial sector is about 18066 MW. The aggregate potential for decentralized solar PV power packs is assessed as 31145 MW.

3.22 Kerala Government Initiatives

ANERT and EMC are working for the penetration of RE development in the state. Furthermore ECS, KSSP, Nirmithi Kendra are the various NGOs working for the promotion of RE and energy conservation. As per the Renewable Purchase Obligation (RPO) notified by the Regulatory Commission, Solar power purchase obligation for distribution licensees is 0.25 per cent of total energy consumption for the year 2010-11 which will increase every year to reach 3 percent by 2022.

The Kerala Government released a solar policy in April 2013 and has been taking significant steps in promoting the use of solar energy in the state. The policy states an increase in the installed capacity of the solar energy sector in the State to 500 MW by 2017 and 1500 MW by 2030. Kerala government planned both on-grid (without battery) and off-grid (with battery) solar programmes which receive acceptance from the public. The following table gives information about current scenario (2016-17) of solar.

Table No. 3.20

Kerala Solar Energy Scenario as on 2017

Major Projects	Units
KSEBL	13 MW
CIAL	21.5 MW
Kasargode Solar Park	36 MW
ANERT Grid Connected Solar	9MW
ANERT Off-Grid Solar Electricity Generation	14 MW

As per recent updates from Renewable Energy Department of KSEBL, the solar energy electricity produced by Kerala is around 90 MW (2017). It should be noted that generation of 1870 MW of solar electricity by 2022 has been planned by KSEB and 12.54 MW only has been achieved so far. In the near future, i.e. after completion of KSEB projects and second phase in Kasargode solar park, solar energy generation capacity of Kerala would be 200 MW. ANERT started another off-grid programme ‘Solar Smart’ which is far from the targeted 500 MW by 2017 as per Solar Energy Policy of Kerala.

3.23 ANERT Initiatives for Promotion of Solar Energy

Agency for Non-conventional Energy and Rural Technology (ANERT), established in 1986 by the Government of Kerala, is functioning as an autonomous body under the Department of Power. It is the nodal agency of Central Ministry MNRE for the implementation and propagation of Non-Conventional sources of energy in the State. ANERT has been designated as the state agency for Renewable Purchase Obligations and Renewable Energy Certificates, by the Kerala State Electricity Regulatory Commission (KSERC). ANERT acts as an intermediary in the promotion of solar energy products. Its objectives are to support the implementation of solar energy project schemes in the state, to provide technical consultancy and financial assistance and popularization and creation of awareness in this regard. ANERT also undertakes the techno economic, socio economic feasibility studies of these technological products. Moreover it conducts seminars, workshops, exhibitions, awareness and orientation and training programmes of this technological product to inculcate awareness among common men. ANERT already formulated and implemented various schemes for the popularization of solar energy products. The following table reveals the major achievements of the agency.

Table No. 3.21

ANERT- Initiatives

Major Milestones		
1	ANERT established	1986
2	IREP (Integrated Rural Energy Programme)	1987
3	Solar PV Programme (Street Light, Lantern, SHS)	1989
4	Solar Thermal Programme	1986
9	Grid Interactive Power Plant	1996
10	Solar Village Electrification (1st phase)	2000-2001
11	11 number's of Off-Grid PV Power Plants	2000-2001
12	Solar Village Electrification (11nd phase)	2001-2002
5	JNNSM (Off-Grid subsidy projects for government building)	2012-13
6	Solar City Programme (TVM & Cochin)	2012-13
7	10000 Solar Rooftop Programme	2012-13
8	Solar Thermal-(100 LPD, SWHs-about 6000 numbers)	2012-13

Source: ANERT Achievements and Programmes, 2013

Table No: 3.21 exhibits the major milestones of ANERT in Kerala with special reference to solar energy. It shows the achievement of the major solar technology products and programmes. From the table, it can be clearly understood that Kerala started its solar energy products by introducing solar lanterns, solar street lights and SHS in 1989. 10000 solar city programme started in 2012-13 is the largest solar programme in Kerala in domestic energy sector**.** A total of 10 MW will be the achievement after the successful completion of this programme. 10 MW of renewable electricity generation is possible through the RTPV installations atop the 10000 rooftops. The notable point is that a gradual shift has been happening in the role of consumers because they are becoming prosumer. If they generate solar electricity more than their own requirement, they are producers.

Table No. 3.22

ANERT Major Achievements in Rooftop Solar Power Plants -12th Plan Period

Year	Solar Capacity(MW) (Offgrid +Grid)	State Plan Fund (Crore)	Central Financial Assistance (Crore)	Private Investment (Crore)	Total (Crore)
2013-14	2	7	10	16	34
2014-15	3	12	17	28	57
2015-16	6	15	24	40	78
2016*	15	36	42	71	149
Total	26	70	93	155	318

Source: ANERT

*Capacity indicated for 2016-17 includes those sanctioned and work ongoing for 7.4MW grid connected and 3.5 MW off-grids, 2 MW ground based power plant at Kuzhalmannan is also included in 2016-17 achievement.

Table gives information regarding the year wise achievement of off-grid and on-grid solar capacity made by ANERT during 2013-14 to 2016-17.

3.24 10000 Roof-Top Solar Power Plants Scheme 2012-13

Kerala has become the first state to create a very ambitious project to generate over 10 MW of solar power from 10000 rooftop solar power systems of 1 KW each. ANERT launched the 10,000 Rooftop Solar Power Plant programme (Table No: 1.1) in September 2012. The total capacity added would be 10 MW. This is expected to reduce the dependency of 10,000 consumers on the utility grid to the extent of 10 MW or 14 to 15 million units (MU) every year. ANERT would be providing a subsidy of ` Rs.39,000 per system from State funds. Ministry of New and Renewable Energy (MNRE) has approved support for the programme under the Jawaharlal Nehru National Solar Mission (JNNSM) at the rate of 30% of the cost of the system. Total subsidy for the system was Rs.92262 (Rs.53262 from MNRE+Rs.39000 from ANERT). The cost of the system around is Rs.200000 in which the central government subsidy and state government subsidy respectively should be available for consumers. The system cost was within a range of 85000 to 100000 after deducting subsidy. They have approved the programme to be completed within a period of 2 years. 6400 numbers of Rooftop Solar Power Plants were installed as on 2015. The project envisages setting up of 1KW off-grid solar photovoltaic rooftop power plants on the top of the buildings which require $15m^2$ of sunny rooftop area. The rationale behind this project was to inculcate awareness and to accelerate the growth of SPV which will be a contribution to clean energy mission.

The companies provide guarantee of 25 years for solar panels, 5 years for battery and inverter. The life of the battery is between 5 to 7 years depending on its efficient usage. So a consumer has to invest again around Rs.50000 for renewal of battery. In 10000 rooftop programme, the beneficiaries have to select channel partners for system implementation from ANERT identified companies. As per ANERT directives, 1kw is capable of producing 4 units of electricity daily. However it cannot operate heavy load appliances due to its limited capacity. It is suitable for working low wattage electrical appliances, like computer, television, lights. As per the recent update, 10000 Rooftop Solar Power Plant Programme completed the installation of 1KW RTPV on 9837 houses which is equivalent to 9.84 MW. ANERT received

MNRE award for Best Innovative Programme for the implementation of 10000 Rooftop Programme.

3.25 Conclusion

It can be observed that a significant growth in RE sector globally and nationally especially in solar energy sector due to the policy initiatives under UNFCCC. RE sector in India's energy mix is also shows a highest growth rate while comparing to other sources. Even though the contribution of RE is negligible in the energy mix of Kerala show a growing trend. Kerala also shows a high potential for solar energy. But the installation is still in nascent stage while considering installed capacity.

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CHAPTER 4

THEORETICAL FRAME WORK - RTPV ADOPTION BEHAVIOUR

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4.1 Introduction

The current research work makes an effort to formulate and examine a theoretical framework regarding the pre-adoption factors, and post-adoption factors of Rooftop Photovoltaic (RTPV) consumers in Kerala. Therefore, this chapter intends to provide a theoretical framework on pre and post adoption behaviour of RTPV. Environmentalism became major criteria for the marketers to influence the consumer buying behavior. In this chapter, the research discusses antecedents of satisfaction (SAT), pre-adoption factors which are considered as the antecedents of Continued Adoption Behaviour (CAI) in the users context and consequences of SAT. Therefore, this chapter is made up by dividing into two sections which include pre-adoption factors of the users which have an effect on CAI, and post-adoption factors, namely antecedents of SAT, consequent Continued Adoption Intention and its outcome loyalty through Repeated Purchase Behaviour (RPB) and Positive Word of Mouth (PWOM).

4.2 Innovation Resistance

Eco innovation is supposed to provide value to consumers by significant reduction in environmental impact. The term eco-innovation is a synonym for green innovation, sustainable innovation, environmental innovation and it covers solar energy system (Karakeya et. Al.,2014). RETs are eco innovations because it decreases the release of harmful substances across its whole life cycle. The researcher would like to operationalise RTPV as a green energy product /eco innovation because of the fact that it minimizes the environmental impact caused by the production, use, transportation and disposal function of conventional energy. According to (Ram and Sheth, 1989), an innovation may bring changes in the customers' established routines and can make conflicts in their earlier belief structure and it would affect the timing of adoption. To make it a successful initiative, a deep understanding of Consumer Behaviour (CB) is a prerequisite.

Marketing literature also mentioned consumer resistance which is a major barrier faced by companies which gradually lead to high product failure. Consumer resistance to innovative products is established in many empirical studies. Obviously the resistance will be higher, especially when it is a High Involvement Technologically Complex product (HITC). Moreover, a group of consumers, are looking forward to sustainable products without considering cost. It is also noted that Sustainable/ethical consumption has increased among consumers especially in Life styles of Health and Sustainability (LOHAS) consumers (Bambaur, 2011).

4.3 Adoption of RTPV

Currently, stimulation of an environment friendly product is a necessity rather than a choice. According to (Hassan, et al. 2012), an innovation means an idea, practice and an object which is perceived as new by the consumers and definitely it would have an impact on the rate of adoption process. Diffusion and adoption are two widely used terms in studying buying behaviour of RETs. Diffusion of eco innovation refersto penetration of a new innovative product in society while adoption happens when an individual adopts or acquires the product. Adoption process means a sequence of actions which will be undertaken by the consumers before acquiring an innovative product. Thus, here diffusion means the commercialization/penetration of an innovative product and adoption means the actual purchase, installation and use of the system.

Consumer buying behaviour/adoption behaviour is the behavior exhibited by the individual/household consumer while purchasing or adopting a product. Consumer involvement is a significant influencing factor on buying decision and the involvement would be higher when the product characterized of high capital cost, information scarcity and of social importance. (Kotler et al. 2011) defined adoption process, "as the mental process through which an individual passes from first hearing about an innovation to final adoption". When considering the stages of adoption, obviously, it consists of six stages:

Awareness: At this stage, consumer become aware of RTPV; however lacks information about the same.

Interest: Consumer will seek information related to product.

Evaluation: Rational thinking by consumers whether to adopt the product or not.

Trial: Consumer wants to try the product by adopting it in small quantity to check whether it meets his expectation.

Adoption: Consumer purchases and starts regular use of that product.

Confirmation: Final stage of buyer decision process is post -purchase behaviour in which consumer takes action based on satisfaction or dissatisfaction.

People may differ in every stage of adoption. There are five innovation adopter categories.

4.4 Classification of Consumers Based on the Time of Adoption of Innovations

Innovators: These types of consumers constitute only three per cent who are venturesome and come first to adopt an innovative product.

Early Adopters: This comprises another three per cent of the market who are ready to adopt a new product just after innovators, but before other consumers.

Early Majority: Those who accept the product just before the average adopter in a social system and constitute about 34 percent of the market. This group is a bit above average in social and economic measures.

Late Majority: Those who are ready to accept only when the product is economically feasible or by peer influence. These types of consumers represent about 34 percent and generally they are of skeptical nature and depend on early majority members for information.

Laggards: They are regarded as the last adopters of an innovation who comprise about 16 percent of the market. They are usually suspicious about the innovation and innovators. Typically they are older and usually they are at the low end at the social and economic scale. They may have chances to adopt when innovators discarded the product in favour of a new concept.

4.5 Theoretical Background for Innovative Renewable Energy Adoption Behavior –A Discussion

Simplest and one of the oldest models of consumer buyer behaviour is stimulus response model. According to that model, the four Ps are treated as marketing stimuli and external forces (economic, technology, politics, cultural) together can produce certain responses in consumer towards the product. Key sets of characteristics that influence the buyer behaviour are cultural, social, personal and psychological. In recent decades, it is noted that there is a transition from gray consumption to green consumption. (Mardaneh et al. 2012) in their research, mentioned about 8 different models of consumer acceptance theory which are TRA (Theory of Reasoned Action),TAM (Technology Acceptance Model), MM (Motivational Theory), TPB (Theory of Planned Behaviour), C-TAM-TPB (Combined TAM and TPB), MPCU (Model of PC Utilization), IDT (Innovation Diffusion Theory), SCT (Social Cognitive Theory). All of these theories found applications in renewable energy acceptance from a consumer perspective.

When analyzing the literature relating to consumer adoption of innovative technological products, Diffusion Theory of Innovation (DTI), Roger 1962), Theory of Reasoned Action (TRA), (Fishbein and Ajzen, 1991), Theory of Planned Behavior (TPB), (Ajzen, 1975) and Technology Acceptance Model (TAM), (Davis, 1989) are the relevant theoretical frameworks used in numerous number of empirical research studies especially in social science and renewable energy context specifically**.** Further, Expectation Confirmation Model (ECM) by (Bhattacherjee, 2009) focuses on the role of satisfaction which acts as the antecedent of continued adoption intention. A large number of empirical literatures proved certain constructs used in these theories are the best predictors for purchase intention. Constructs relating to satisfaction involved in this research were, 4Ps, Service Oriented Aspects (SOA), and Ease of Use (EOU). Overall, it is noted that Actual Purchase Behaviour (APB),Satisfaction (SAT), Continued Adoption Intention (CAI), and loyalty through Repeated Purchase Behaviour (RPB) and Positive Word of Mouth (PWOM) have taken centre stage in this research.

Researchers all over the world have already established numerous determinants of RET adoption. However the researcher here tried to integrate various theories which are empirically proved internationally based on review of literature and selected relevant constructs. Even they are internationally proved theories, there exist regional differences in the determinants of technology. Therefore the researcher developed a conceptual framework by integrating relevant constructs from technology adoption and consumer behavior literature in order to find out the drives for Renewable Energy (RE) product adoption especially Rooftop Photovoltaic (RTPV). Additionally, researcher added some constructs based on literature which best fit in RE context. It is difficult and also important to assess whether the client has developed customer Continued Adoption Intention (CAI) in the form of either Positive Word of Mouth (PWOM) or Repeated Purchase Behaviour (RPB) after adoption. This study will also help to understand how customer loyalty formed in two dimensions in the RTPV adoption context. There is a dearth of studies which analyse both pre and post RTPV adoption concepts formation simultaneously in Kerala context.

4.6 Diffusion of Innovation Theory (Roger, 1962)

(Bollinger & Gillingham, 2010) mentioned that despite the fact that diffusion is an interdisciplinary field, this theory has been used since 1960s for studying a lot of innovations. Eco-innovation may be a product, process, idea or service which is novel to the individuals which ultimately result in the welfare of the environment by reducing pollution and other negative impacts while comparing with the life cycle of other alternatives. Innovation Diffusion Theory (IDT) by (Roger, 1962) can find its application in this research because RTPV is an innovative sustainable product. Roger states the characteristics which affect the adoption process of an innovation. In addition to the characteristics, Roger described the stages in the process of adoption:

1) Knowledge about the Innovation
2) Persuasion- formation of attitude
3) Decision
4) Implementation
5) Confirmation

(Hwang, 2014) indicated that knowledge about the innovation and formation of attitude would play a major role in making a decision whether to accept or reject a product. Knowledge about the innovation would lead to persuasion stage where attitude formation happens, and this will play a critical role in accepting or rejecting a product. The positive or negative attitude develops during this persuasion stage depending on the perceived characteristics or attributes which an individual receives in the knowledge stage.

According to (Roger, 1962), there are five perceived attributes of innovation, namely relative advantage, compatibility, complexity, triability and observability. He argued that these factors would affect the adoption of an innovative product. If an individual is high in relative advantage, compatiability, triability, observability and less in complexity regarding a product, it indicates that the product would be success. (Hwang, 2014; Alam et al. 2014) indicated that among these attributes, the role of relative advantage is very crucial which is empirically validated by a large number of studies.

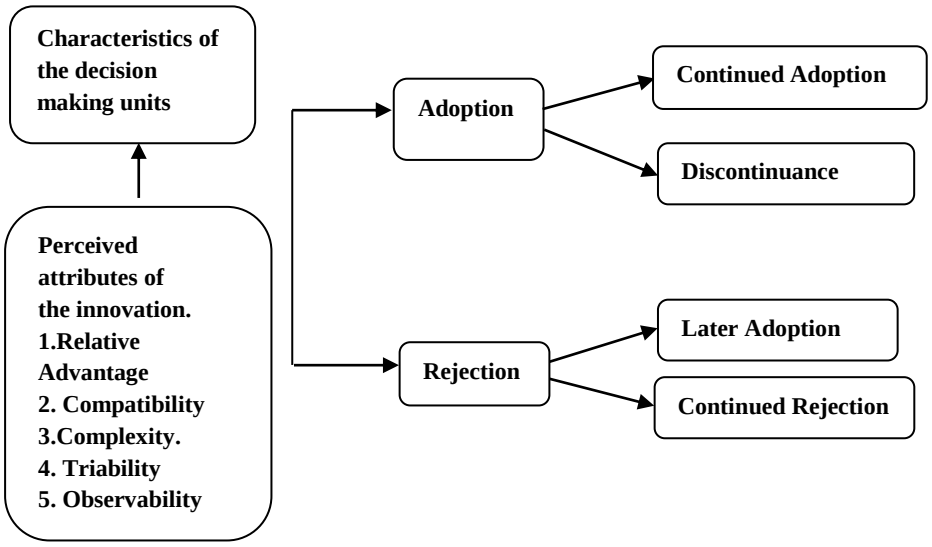


Figure No. 4.1

Diffusion of Innovation model by (Everett M Roger, 1962)

Source: M.C.Claudy et al (2010)

1. **Relative Advantage:** Some benefits of the products are perceived by the consumers as new in relation with the existing products. Cost, ease of use, environment and social benefits can be perceived by the individual as relative advantage.
2. **Compatibility**: It is consistency with the existing values, past experiences and needs of prospective adopters. It refers to the capability of the innovation to match with the values and experience of the consumers.
3. **Complexity:** Degree of difficulty/ ease of using the system /product. Obviously it will have an inverse relation with the system.
4. **Triability:** The ability of the innovative product for trial or experience in a small capacity/quantity by the consumer.
5. **Observability:** It indicates the visibility of the results of the innovation.

4.7 Theory of Reasoned Action (TRA) Fishbein and Ajzen, 1975

A well established model TRA (Theory of Reasoned Action) developed by Ajzen and Fishbein in 1980 is helpful in understanding the antecedents of purchase behaviour**.** This theory states that adoption intention can be formed by attitudes and subjective norms and purchase intention is a proven antecedent of actual purchase behaviour. These theories are used widely to investigate the adoption intention of innovative renewable energy products in national and international studies.

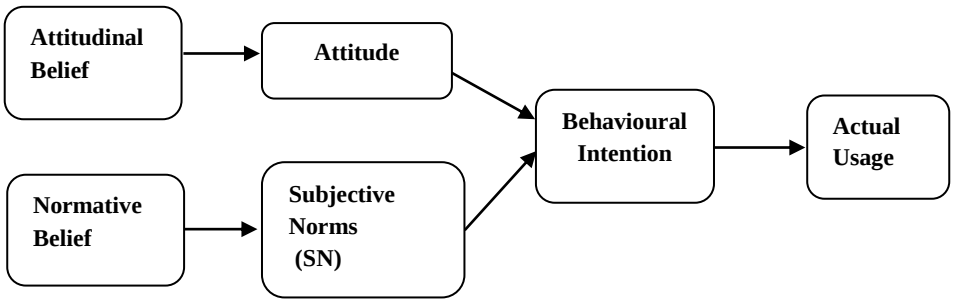


Figure No. 4.2

TRAModel (Fishbein&Ajzen, 1975)

4.7.1 Attitude

(Taylor & Todd, 1995) defined "attitude as an individual's positive or negative feelings about performing and conducting a specific behaviour. Attitude is a function of cognitive belief structure which formed through the belief of individual about the consequences of carrying out a behaviour and evaluation of positive and negative aspects of consequences (Hausenblas, Carron, & Mack, 1997). Attitude towards RE can be defined as the perception of the potential users, their briefs about the benefits and drawbacks of the new technology and about their intention to buy the technology (Alam & Rashid, 2013). It can be concluded that attitude is the totality of positive and negative evaluation of carrying out a particular behaviour. So here the researcher would like to know the influence of incentivized/subsidized market on formation of favourable image on consumers RTPV adoption decision.

4.7.2 Subjective Norm (SN)

(Hassan et al. 2012**)** point out that SN is a critical factor in the adoption of Environment Friendly Products by creating interest and desire. (Hausenblas, Carron, & Mack, 1997) considered the combination of normative beliefs which indicate the perception about the individual's belief about the expectations of others and motivation to accomplish the expectation. An individual may approve or disapprove certain behaviour based on others perception. (Shabnam, 2013) and (Lynch, & Martin, 2010) considered it as a highly socially oriented variable or it's a social force which leads a person to carry or not carry out a particular behaviour**.**

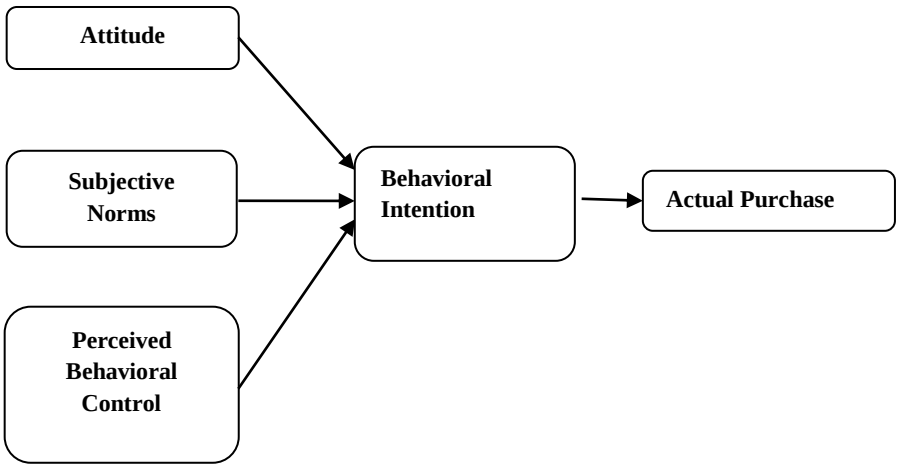
4.7.3 Purchase Intention

(Naing & Chaipoopirutana, 2014). Mentioned that purchase intention is a behavioural tendency of a customer who is proposes to purchase a product and is an important indicator of actual purchase behaviour. (Hausenblas, Carron & Mack, 1997) indicated intention as an expectation which is a formulated conscious plan to perform or not to perform the behaviour. (Kumar, 2012) considered it as the direct predecessor to the Actual Purchase Behaviour (APB). Therefore it's the behavioral

tendency to undertake or not to undertake an action which is also act as the antecedent and direct determinant of APB.

4.8 Theory of Planned Behaviour (TPB) by (Ajzen, 1991)

TPB is an extension of TRA and it is also a widely cited behavioural theory in which one more construct called PBC (Perceived Behavioural Control) is added to determine the behavioural intention. PBC refers to the perceived ease or difficulty of performing the behaviour. Both TRA and TPB assert that behavior is a direct function of intention. Like TRA, TPB postulates that behaviour intention is a function of (ATTI+SN) with an additional construct PBC.



FigureNo.4.3

TPBModel (Fishbein & Ajzen, 1975)

4.9 Technology Acceptance Model (TAM) by Davis, (1989)

Numerous researches proved the fact that TAM is an appropriate model to understand individual's technology acceptance behaviour in the context of renewable energy. This theoretical model was proposed by Davis for understanding the user's adoption of innovative technology. It is also one of the most cited theories when investigating user's purchase intention of a new technology. Kumar, B. (2012) points out that this model is mainly used to understand ethical behavior and purchasing of

environment- friendly products. TAM is an adaptation from TRA developed (Fishbein and Ajzen, 1991) and TPB (Ajzen,1975). In TAM model, two key variables, namely perceived usefulness, perceived ease of use of the system, play a major role to determine the user's attitude and intention for using technology-based products**.** This theory also found application in Continued Adoption Intention of technological products.

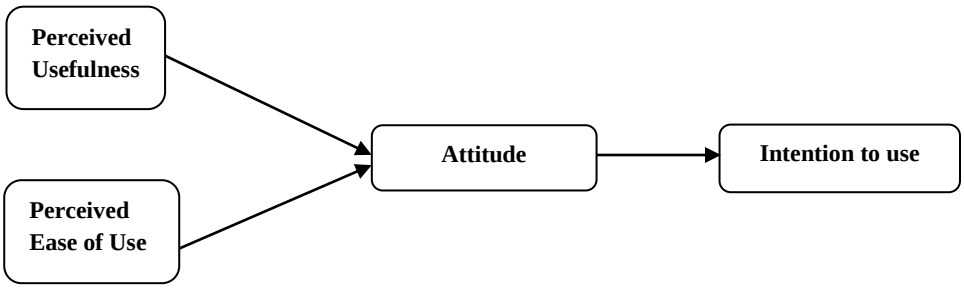


Figure No. 4.4

Technology Acceptance Model (TAM) Davis, 1989

4.9.1 Perceived usefulness:

Many researchers shed light on the utility of the system which played a significant role in the adoption of a technological product. According to Casaló, Flavián & Guinalíu, 2008) usability indicates a combination of the effort essential to use a system, the ease of understanding the composition of the system, its function, and simplicity of use. They mentioned that perceived usability is an indirect antecedent of both consumer loyalty and PWOM through SAT. It indicates the person's belief about the degree of improvement of his or her job performance by using a particular system. As (Hwang, 2014) suggested, (Davis, 1989) believed that consumer perception of usefulness directly influences attitude towards technology adoption. (Averdung, 2011), referred to it as the consumer's perception of the advantages of usage of the product.

4.9.2 Perceived Ease of Use

As suggested by (Davis, 1989), (Hwang, 2014), stated that 'Ease of Use' is "the degree to which a person believes that using a particular system would be free of

effort,". As suggested by (Straub, 1999), (Alam et al. 2014) defined EOU as the degree to which user easily understands, operates and maintains a new technology. (Bollinger & Gillingham, 2010) revealed that it is the perception that using a specific technology does not require additional work and energy. (Alam & Rashid, 2013) noted that EOU is influenced by users opinion regarding installation, regular use, maintenance and recycling of the new technology and is explained in the technical stand point of view**. (**Casaló, Flavián & Guinalíu, 2008) stated that it is the effort required to use a system-viz. the simplicity of understanding the configuration of system, its functions and effortlessness of use and declared that it has a positive direct influence on customer satisfaction.

The proposed framework in this research adapts two constructs from TAM (Davis, 1989), namely Perceived Usefulness (PU) and Ease of Use (EU). Knowledge /Awareness (AWA) and Relative Advantage (RA)/ Environmental Attitude (EA), Continued Adoption from IDT (Innovation Diffusion Theory (Roger, 1995), SN (Subjective Norm) and Attitude from TRA (Fishbein and Ajzen (1991), TPB (Ajzen, 1975) towards assessing adoption behavior of the RTPV consumers in Kerala.

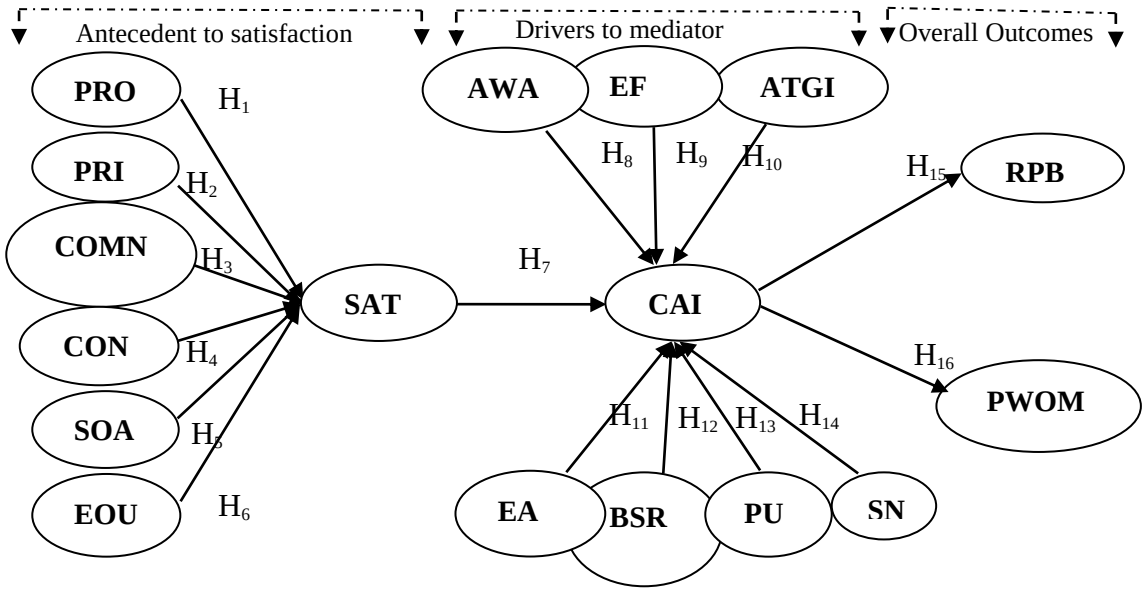


Figure No.4.5

Conceptual Framework Showing the Study Hypotheses (Antecedents and Consequences of RTPV Adoption)

Note: SAT=Satisfaction, PRO=Product Oriented Aspects, PRI=Price Oriented Aspects, COMN=Communication, CON=Convenience, SOA=Service Oriented Aspects, EOU=Ease of Use, AW= Awareness regarding RTPV, EF= Economic Factors, ATGI=Attitude towards Government Initiatives, EA= Environmental Attitude/ Relative Advantage, BS = Buyer Social Responsibility, PU=Perceived Usefulness, S =Subjective Norms, CAI=Continued Adoption Intention, RPB= Repeated Purchase Behavior, PWOM=Positive Word of Mouth.

Table No. 4.1

Sources of Model Constructs

Relevant Constructs	Source
Environmental Concern/ Relative Advantage	
Environmental concern with Purchase behavior	Kumar, B. (2012),Averdung, A., &Wagenfuehrer, D. (2011) Sahu, T. (2012), Bang, H. K., Ellinger, A. E., Hadjimarcou, J., &Traichal, P. A. (2000),Zhai, P., & Williams, E. D. (2012),Hessami, H. Z., &Yousefi, P. (2013),Memar, N., & Ahmed, S. A. (2012), Dagher, G. K., Itani, O., &Kassar, A. N. (2015), Follows and Jobber (2000) adapted from Dagher, G. K., Itani, O., &Kassar, A. N. (2015), Wu, S. I., & Chen, Y. J. (2014), Averdung, A., &Wagenfuehrer, D. (2011), Suki, N. M. (2013).
Relative Advantage and Adoption	Hasan, J., Hartoyo, H., Sumarwan, U., &Suharjo, B. (2012),Labay, D. G., & Kinnear, T. C. (1981),Alam, S. S., Hashim, N. H. N., Rashid, M., Omar, N. A., Ahsan, N., & Ismail, M. D. (2014),Faiers, A., &Neame, C. (2006), Chavan (2013),Arkesteijn, K., &Oerlemans, L.(2005),Ballestrazzi, R., Mason, M. C., &Nassivera, F. (2011), Chen, T. B., & Chai, L. T. (2010).
Economic Factors (Price, Subsidy relation with	Wu, S. I., & Chen, Y. J. (2014), Delafrouz,N., Momenpour,M., Goli,A., &Fatemeh.

Adoption)	(2014),Chavan,A.S., &Welling,M.N. (2013), Bang, H. K., Ellinger, A. E., Hadjimarcou, J., &Traichal, P. A. (2000), Doris Knutzen (2011),Awan, U., &AamerRaza, M. (2010),Wahi, R. R. H., &Ahsan, N. U. (2012),Dhoubhadel, S. (2010),Zhai, P., & Williams, E. D. (2012),B.Bhargava(1995), Morgan Anne Wampler (2011),Ansar, N. (2013),Hessami, H. Z., &Yousefi, P. (2013),Labay, D. G., & Kinnear, T. C. (1981),Faiers, A., &Neame, C. (2006),Claudy, M. (2011), Van Hemman (2011),Huijts, N. M., Molin, E. J., &Steg, L. (2012), Shabnam, S. A. A. D. I. A. (2013).
Subjective Norms /SN with Adoption	Hasan, J.,et al (2012), Bollinger, B., & Gillingham, K. (2010)**,** Feng, H. Y. (2012).
Perceived Usefulness/PU with Adoption	NREL (2011), Averdung, A., &Wagenfuehrer, D. (2011), Chavan,A.S., &Welling,M.N. (2013),Feng, H. Y. (2012).
Attitude Towards Government Attitude/ATGI with Adoption	Chen,T.B.,& Chai,L.T (2010), Chavan,A.S., & Welling,M.N. (2013),Samad, H. A., Khandker, S. R., Asaduzzaman, M., &Yunus, M. (2013), Dhoubbadel,S (2010), FirduusMuhammed& Roberto Ramirez(2011), Byrne,J.,&Lado(2011), SurendraPimparkhedkar (2007),MaksymSysoiev (2012),Miguel Mendonca (2012), LockandeUday
BSR	D.Webb,L.Mohr (2007),E.Webster (2011)
Awareness/AWA with technology adoption	Wu, S. I., & Chen, Y. J. (2014).,Sahu, T .(2013), Bang, H. K., Ellinger, A. E., Hadjimarcou, J., &Traichal, P. A. (2000), NREL (2011),Hessami, H. Z., &Yousefi, P. (2013) , Memar, N., & Ahmed, S. A. (2012),Keriri,(2013), (Alam et al, 2014), MohdSuki, N. (2013). N.M.A Hujits

	(2012),MariousClaudy,M.C., and O'Driscoll,A.,(2008)
Socio-Demographic Variables	Delafrouz,N. et al (2014), Havas , L.,&Latz,S., (2012),Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2005). Hessami, H. Z., &Yousefi, P. (2013), Answar, N.,(2013), Memar, N., & Ahmed, S. A. (2012), Feng (2012), Keriri,(2013), G.Labay&Duncan(2014), Rai&Macandrews,(2008),Huijts, N. M., Molin, E. J., &Steg, L. (2012),Claudy, M., &O'Driscoll, A. (2008). Abrahamse, W., Steg, L., Vlek, C., &Rothengatter, T. (2005).,Labay, D. G., & Kinnear, T. C. (1981).
Service Quality & Satisfaction to consumers Purchase Intentions	Han, H., & Kim, Y. (2010).,Taylor, S.A., &Baker,T.L.(2001), Oh,H.,(1999), Maxham,(2001),Kassim &Abdullah (2010)
Marketing Mix and Word of Mouth, Marketing Mix and Consumer Satisfaction Product quality & Satisfaction	Cengiz, E., &Yayla, H. E. (2007).,DerejeAlelign,et al (2014), Cronin, J. J., Smith, J. S., Gleim, M. R., Ramirez, E., & Martinez, J. D. (2011). Chang, N. J., & Fong, C. M. (2010). Delafrouz,N., et al (2014); Hasan et al (2012); Wu, S. I., & Chen, Y. J. (2014)., Wahi, R. R. H., &Ahsan, N. U. (2012),Dhoubhadel,S., (2010) ; Morgan Anne Wampler (2011);Delafrooz, N., Taleghani, M., &Nouri, B. (2014)B.Bharghava(1995);Herring, H., Caird, S., & Roy, R. (2007).Liza Havas and Sam Latz (2012); Jacobsson,R., (2013);Margolis, R., &Zuboy, J. (2006). Lesieutre,A.L (1992); Ritcher,J., (2008); Chavan,A.S., &Welling,M.N. (2013),Zhai,P., and Williams,E.D. (2012), Claudy,M (2011); Anderson,

	E. W., Fornell, C., & Lehmann, D. R. (1994). Mittal, V., & Kamakura, W. A. (2001). Karakaya, E., &Sriwannawit, P. (2015).SveinOltarOlsan (2002); G Labay Duncan, C. K. T. (2014). VAN HEMMEN, H. A. N. N. A. H. (2011). D.W Straub (1999) accessed from Alam, S. S., Hashim, N. H. N., Rashid, M., Omar, N. A., Ahsan, N., & Ismail, M. D. (2014).Philip Kotler et al (2010); (Kumar,B., (2012); Suki,N.M (2013),Naing, K. W., &Chaipoopirutana, S. (2014)
CAI	Bhattaterjee ,2001 --AlamgirHossain, M., &Quaddus, M. (2011), Hong, S., Thong, J. Y., & Tam, K. Y. (2006),
Loyalty (RPB & PWOM)	Olsen, S. O. (2002), (Oliver, 1997), (Bansky, 1994), (Reichheld, 1996), (McMullan, 2005), (Stank et al 1999), (Cengiz &Yayla, 2007), (Oh, 1999), (Dabholkar et al, 1995), (Jiewanto et al; 2012), (Babin, 2005)

4.10 Pre-adoption constructs

4.10.1 RTPV Awareness

(Kotler et al., 2011) mentioned that companies/make huge investments in conducting ethnographic research type of research which means deep understanding of consumer behaviour for widening or expanding the market. Previous researches related to adaptation of green technologies clearly illustrated that lack of awareness is a crucial factor which restricts the uptake of RETs. Knowledge and awareness are found to have a major determinant in the consumer decision process especially in the case of technology adoption (Alam and Rashid, 2012). (Alam et al., 2014) describes awareness as the degree of users cognizant of present technology, its benefits, negative aspect and updation of current technology. Knowledge indicates detailed

understanding about the features, functions of components and latest updates relating to the support policies for the growth of RTPV. Awareness is the primary stage when considering the consumer adoption process of an innovative product. As the purchase decision of RTPV is a complex product decision, the customer may gather information before adoption from several sources like personal, commercial and public sources and experimental sources. Here adequate level of awareness means the level of awareness about basic use, environmental impact and financial aspects.

4.10.2 Economic Factors (EF)

Cost of a technology consists of personal financial cost (purchase cost) and social costs (subsidy) (Hujits et al., 2012). However (Shabnam, 2013) points out that some consumers consider socio-environmental costs because they might felt that the cost of protecting the environment is more important. Obviously, there exists a general concern about the high cost of green product. The consumer who considers the socio-economic cost may accept this prestige pricing. According to (VAN HEMMEN, 2011) a consumer may engage in heuristic or mental accounting rather than actual cost benefit analysis, while adopting such expensive innovative product. Every consumer must have a perceived price concept about the product which is an overall concept including the paid currency and non currency costs. According to (Duncan,1981) "Economic factors include initial cost, payback period, rising cost of other energy sources, availability of government incentives or programs to offset installation cost"**. (**Adachi, 2009) classified competitiveness of green energy with conventional energy sources, and negative externalities of conventional energy into monetary category. The government incentives play a major role in making the investment financially viable by reducing the payback. (Arkesteijn & Oerlemans, 2005) mentioned economical variable as willingness to pay premium, higher price and level of disposable income.

4.10.3 Attitude towards Government Initiatives (ATGI)

Attitude refers to the overall positive or negative temperament and it is crucial as it affects behavioural intention (Kok and Siero, 1985). It is a comprehensive or overall evaluative judgment held by the people towards any action. (Kotler, 2003)

defined Attitude, “A person’s emotional way of thinking and propensity to act towards an object or idea”. “It is a state of readiness for a definite action” (Allport (1935).

Previous studies indicated that eco-innovations like RETs need political support (Karakeya et al., 2014). All over the world, the growth of solar energy technologies is driven by government incentives. Wider adoption of SPV is discouraged by the initial capital investment costs. Government policies and different types of economic incentives have always been present in the SPV market to compensate the high involvement costs.

There is SPV installation with or without subsidy happens in Kerala, i.e. through government intervened market (subsidy driven) and private market. A market with government regulation gives an organized form and more authenticity. It is also called subsidy driven market or government intervened /regulated /organized market. In government intervened market ,there is government perception market and public perception market, i.e. Government driven market divided into Government’s consumption and public perception market. With the intention of the government to reduce the financial barrier to the acceleration of solar PV in Kerala, “10000 off-grid rooftop solar power plant programme” and other initiatives are introduced as part of National Solar Mission (NSM). Therefore consumer’s perception of these government intervened market initiatives constitute this dimension. Hence it is policy driven, with the presence of direct capital subsidy element. It’s a voluntary market for household consumers.

4.10.4 Relative Advantage (RA) / Environmental Attitude (EA)

Literature on Consumer adoption process relating to RETs has clearly illustrated the importance of Environmental Attitude. Environmental concern can represent an individual’s compassion, likes and dislikes, and concern about environment (Dagher & Kassar, 2015). Consumer’s buying decision is directly influenced by the environmental friendliness of an innovation (Averdung & Wagenfuehrer, 2011). Ecological attitude states the desire to support the environment. Ignoring environmental pressure is impossible (Delafrouz et al., 2014). Recently

consumers began to express their environmental concern /consciousness and adding environmental criteria in their purchasing decision. (Alam and Rashid, 2012) treated environmental concern/benefits as relative advantage of solar energy when compared with non conventional energy sources. It is noted that environmental concern, and attitude played a crucial role in earlier studies of consumer adoption of RETs. As RTPV is an innovative technological product, researcher in this study, adopted one relevant construct RA (Relative Advantage) from IDT framework and treated it as environmental attitude towards RTPV. For the purpose of this research, relative advantage is operationalised in a manner that is consistent with a green innovative product. (Hassan et al., 2012) defined that RA actually represents " new attributes perceived by the consumers and those not dictated by the producers and these attributes can be measured in terms of economic, social prestige, convenience and SAT. " (Vasseur & Kemp, 2015). Refers to RA as the perceived superiority of the innovation when compared with existing ones. In the case of PV, cost of adoption, price of fossil fuels, aesthetics of a roof with solar panels, the desire to be environmentally responsible etc can be viewed as RA. An innovative product can be perceived on its relative advantage. (Alam et al., 2014) argued that consumers have an emotional attachment with RE and they could consider this technology from an environmental and social perspective.

4.10.5 Buyer Social Responsibility (BSR)

Corporate social responsibility is a familiar term for the customers which proved to have a positive impact on consumers purchase intent. (Mohr and Deborah 2005), proved a link between favorite attitudes of consumers towards the CSR performance of companies. Here, buyer, as a member of society, has certain responsibilities towards the society. He/she is supposed to harm the environment by behavioural actions. Social marketing, emphasized the importance of consumers, company and society's well being while doing business. According to (Webster, 1975) accessed from (Laroche, Bergeron & Barbaro-Forleo, 2001) a socially conscious consumer is concerned about the public consequences of his/her private consumption or make effort to use his /her purchasing power for bringing a social change. This refers to some kind of social involvement. A socially conscious

customer is more concerned about social problems. (Mohr et al., 2001) mentioned that Socially Responsible Consumption Behavior (SRCB) is the minimum negative consequence or impact on society and environment, achieving long term benefit in the acquirement, handling and discarding of the products. In this research, buyer social responsibility indicates socially conscious consumer behaviour which focuses on the well being of society. By taking a decision to adopt RTPV, the consumers are exhibiting the social responsibility and here it indicates the societal aspects of energy generation. Therefore BSR is critically an important variable in the current context. Social benefits are a wider term which includes the environmental benefits and more aspects. The SRPD (Socially Responsible Purchase and Disposal) and the scale developed (Webb et al., 2007) to measure the construct BSR shows higher involvement in the societal problem. BSR includes various aspects, like buyer's perception of increasing energy security, reducing rural energy poverty, elimination of risky sources of energy, improvement of energy infrastructure, compatibility of the usage of RTPV system in the living context in Kerala.

4.10.6 Post adoption behaviour

Post adoption behaviour refers to either continuation or discontinuation of the usage of the system in future. TAM and DIT have been used to study the post adoption usage behavior even though they are more focused on pre-adoption factors (Hong, Thong & Tam, 2006). Researchers proved that post-purchase behaviour is the key success factors of an ecological innovation (Averdung and Wagenfuehrer, 2011).

Satisfaction is a widely studied and debated concept. (Cronin, 2000) stated "satisfaction has the potential to influence consumer behaviour intention and customer retention" (Mittal et al., 1998) defined satisfaction may be merely a judgment with cognitive and affective dimensions. Satisfaction is considered critical to establish long term relationship with the customer and to secure repeat business. As mentioned by (Oliver, 1992), (Patterson & Spreng, 1997) observed "Satisfaction is a consumer's post-purchase evaluation and affective response to the overall product or service experience." Furthermore satisfaction is the ultimate determinant of marketing success. (Yi, 1991), mentioned Confirmation and Disconfirmation (C/D)which refers

to consumer's who compare their pre purchase expectations, quality with norms and "any perceived discrepancy between the two leads to increased/decreased satisfaction. Similarly he also mentioned that attribute level satisfaction significantly affects the overall satisfaction and have a direct impact on repurchase intention and (oliver, 1981) adapted from (Oh, 1999). (Mittal et al., 1998) mentioned the asymmetric impact of negative and positive attribute level performance on overall satisfaction and repurchase intention and post-purchase experience of the consumers mostly in the form of attribute level. A consumer may be satisfied and dissatisfied with the different aspects/attributes of the same product and studying attribute level satisfaction would enhance both conceptual and empirical understanding of the phenomenon.

4.11 Antecedents of SAT

Here, in this research, SAT is described as the function of four Ps+ SOA+EOU. Four Ps are known as 'marketing mix' which is a universally accepted convention, and recognized as an antecedent of satisfaction which consists of a set of controllable marketing tools, namely product, price, place and promotion (Four Ps) from the seller's perspective and it can be termed as Four Cs consumer solution, cost, convenience and communication from the consumer perspective for getting the response from the target market and also creating value for the consumers. Therefore the researcher here treated 'marketing mix' as different product related attributes /dimensions which contribute to overall satisfaction.

4.11.1 Product Oriented Aspects (POA): Product Quality is one of the important attributes and the satisfaction of it leads to consumer delight. Quality is the antecedent of customer satisfaction (Anderson, 1994); (Chang & Fong, 2010) indicated that "product quality dimensions include product design, package, features and warranties. (Naing & Chaipoopirutana, 2014) noted "perceived quality is the consumer's present consumption experience upon overall excellence of products." (Duncan, 2014) state in his research that product specified factors are of highest concern to the adopters and knowledgable adopters of SPV. (Wu & Chen, 2014) mentioned 'perceived quality' is consumer perception on the quality of a product and represents consumers overall judgement. As mentioned by (Pettrick, 2002), (Wu & Chen, 2014) stated that product

quality is measured by using four dimensions i.e. superiority, consistency, dependability and reliability. American Society for Quality Control defines product quality "as the totality of features and characteristics of product or service that bear on its ability to satisfy stated and implied needs". (Kotler and Armstrong, 2005) mentioned it as the ability of a product to perform its functions. In this research, product related factors mean quality and reliability of the system itself, product warranties and the efficiency of the current system. It describes satisfaction with the components quality performance and utility of the SPV system after purchase/installation as guaranteed by the company which will have a significant role in delivering value to the customer.

4.11.2 PRICE: It's about the feeling that consumers have about the price of a product. It's an overall concept including the paid currency and non- currency costs. As suggested by (Petrick, 2002), (Wu & Chen, 2014) mentioned 6 indices to measure perceived price-excellent purchase, equivalent value, above the value, reasonable price, economic and fair trade. (VAN HEMMEN, 2011) mentioned that price has the strongest correlation with solar adoption and also shows a negative relationship. (Wahi, 2012) pointed out that companies must focus on cost value perception. (Awan and Raza, 2010) identified that lower price influence the customers towards choosing the green energy. (Wampler and Bhargava, 1995) proved that the investment in RTPV installation is definitely cost beneficial in the long run/ life cycle analysis basis. Here the total cost represents the cost which is incurred by the consumer for the adoption/installation of the SPV system after subsidy. Price also indicates the sacrifice made by the customer for receiving an energy efficient product.

4.11.3 Communication (COMN): It comprises the dissemination of information, updating of new knowledge about the existing product between company and consumer by various ways. (Arkesteijn & Oerlemans, 2005) explained the importance of Communication as per Roger model, viz. internal influence diffusion by interpersonal communication through WOM and through social networks and External influence is diffusion by informational sources external to the interpersonal interaction between individuals. External influence channels play their most important

role in the knowledge factor. Effects of internal influence channels are more important on the persuasion and decision function.

4.11.4 Convenience (CON): (Kumar, 2012) stated that "availability of a product is the degree of difficulty or ease in locating and obtaining a product for consumption." Control on availability is treated as one of the variables under PBC (Perceived Behavioural Control) under theory TPB**.** Here, this construct includes the accessibility of the company or dealers and availability of system components within the consumer's district. As RTPV is a high involvement product, the accessibility of suppliers becomes more important**. (**Vermer and Verbeke, 2006) mentioned 52 per cent of people who have an intention of purchasing earth sustainable food were demotivated by lack of availability, inconvenience and price. Low perceived availability has an impact on positive attitude despite the low intention. Scarcity of shops and market affects the convenience demanded by the consumers.

4.11.5 Service Oriented Aspects (SOA): SOA is a unique construct (Taylor, 1994) which is widely studied and debated (Cronin et al, 2000). (Kassim, 2010) mentioned SQ is the measure of company's capability and willingness to provide prompt service when customers face problems. As suggested by (Bitner, 1994), (Taylor, 1994) mentioned SQ as overall feeling of the consumers about relative superiority or inferiority of organization and its services. (Cronin, 2000) considered SQ as an important determinant of favorable behavioral intentions. If service quality is not satisfactory, it is termed as service failure. Timely responding to service failures is critical for enhancing customer retention. Earlier researches show that service quality alone significantly increases satisfaction as well as repurchase intention/PWOM. Services are characterized by intangibility, inseparability, variability and perishability and it would require special attention because of its crucial role. There are five dimensions for measuring SQ. SERVQUAL or Gap Analysis model derived from their study contains five major dimensions. Here SOA is measured through asking question from each five dimensions of service quality.

4.12 Consequences of SAT

In this research, consequence of SAT, means the outcome behavior of satisfied consumers of RTPV.

4.12.1 Continued Adoption Intention/User Intention over Time

(Oh, 1999) Repurchase Intention is a direct consequence of perception, value and satisfaction. Satisfaction leads to repurchase intention and then to loyalty. Satisfaction is treated as the important antecedent of repurchase intention (Patterson & Spreng, 1997).

(Liao, 2009) mentioned that the objective of Expectation Confirmation Model (ECM) was to evaluate the individual's continuance and loyalty to the system use and emphasizes that user satisfaction is the most important requirement determining a user intention for continued use. ECM focuses on factors that influence retention and loyalty which are ensured for long term viability and success.

ECM theory by (Bhattacherjee, 2001) states that the level of confirmation resulting from the usage experience and the importance of satisfaction which lead to Continued Adoption Intention (CAI). Expectation - Confirmation theory mentioned that continued usage intention is reliant on the users level of satisfaction. In this research, satisfaction captured the confirmation, because by measuring SAT, it is justifying that the RTPV is effective.

Further, Technology Acceptance Model (TAM) is parsimonious and is also a widely accepted framework for understanding users' IT acceptance process and is also used to demonstrate the predictive ability of post-adoption usage. Even though TAM emphasized pre-adoption factors, this model is also applied to study continuance and post- adoption behaviour with diverse application contexts.

According to (Bhattaterjee, 2001), 'Initial adoption of an innovation is important for realizing its success, the long term viability and its ultimate success depends on its continued use" and emphasized the role of SAT for continued use. (Hong, Thong & Tam, 2006) mentioned "increasing customer retention by five per

cent could result in decrease in operating cost by 18 per cent and contribute to an increase in profits by 25 per cent to 95 per cent." He further mentioned continued usage decision is similar to consumer repeat purchase decision and there is a considerable difference between pre and post adoption behaviour. He further stated that satisfaction measured from the direct experience of consumers was the major determinant of CAI. (Ajzen and Fishbein, 1980) adapted from (Cho, Cheng & Lai, 2009) defined Continued Usage Intention (CUI) "as a measure of the likelihood that a person will continue using a technology or a system". (Kim, & Wachter, 2013) stated that acceptance is a stage at which something selected for use by people while" engagement is the state of being involved, occupied, retained and intrinsically interested in something." Successful technologies must engage users and this will finally lead to future loyal users through satisfaction and increasing user engagement can improve the chances of success of that business. (Pagani, 2011) mentioned 'Engagement' is beyond the concept of acceptance that is a subset of engagement. Further, (Schaufeli et al., 2002) state 'Engagement' is not momentary and specific state, but it is a more persistent and pervasive cognitive affective state. (Harter et al., 2002), there is a strong correlation between engagement and profitability through customer satisfaction, increased sales, employee retention and productivity. Continuous Engagement is treated as a part of their life while acceptance is a starting point.

4.12.2 Repeat Purchase Behaviour /Further Capacity Addition

The conceptualization and empirical validation for the construct loyalty have been recognized important for all products, services and companies for decades. However, the same in the RTPV context in Kerala has not been addressed yet. (Oliver, 1997) defined customers' loyalty as "a deeply held commitment to re-buying or re-patronizing a preferred product or service consistently in the future, despite situational influences and marketing efforts having the potential to cause switching behavior." The cost of recruiting a new customer is said to be five times more than the cost of keeping an existing customer (Bansky, 1994). Studies have recognized that five percent increase in customer retention can generate a profit growth of 25-95 percent across a range of industries (Reichheld, 1996). (McMullan, 2005) states

'loyalty can be viewed as the future behaviour commitment to purchase a product". Loyalty has been described as repeat purchase behavior (Stank et al 1999). Loyalty is seen as a better predictor of actual behavior. (Taylor, 1998) mentioned Customer loyalty indices (CLI) are behavior based, viz. likelihood to repurchase the product, likelihood to recommend the product to others, and overall satisfaction. For the purpose of this research, loyalty is considered as a fundamental strategic component with the two dimensional conceptualization integrating behavioural and attitudinal elements (Bloerer, 1998). (Olsen, 2002) loyalty is measured on self reported repurchases behaviour instead of purchase intention. (Spreng, et al., 1995) state that behavioural intention for WOM and repurchase intention are influenced by overall satisfaction which in turn depends on specific attributes including product quality dimensions, price dimensions etc. As suggested by (Bloemer and Kasper, 1995), (Olsen, 2002), believed that it is frequent behaviour and the most common assessment of loyalty are behavioral frequency or repurchase pattern.

4.12.3 ALTRUISM/ PWOM/ RMN/ Social Contagion

WOM is a global phenomenon (Cengiz &Yayla, 2007) which has received considerable attention and its importance is well recognized in marketing literature. WOM refers to the verbal communication between actual and potential customers. People assign high credibility to what they hear, especially when they make purchase decisions. (Oh, 1999) stated that WOM communication intention is a direct and combined function of perception, value, SAT and repurchase intention. As suggested by (Dabholkar et al, 1995), (Jiewanto et al; 2012) mentioned that WOM is the clients willingness to recommend the product and service to others in the near future. (Babin, 2005) indicated that Consumer satisfaction and WOM are important marketing outcomes affecting the profitability of the enterprise. "WOM intent is defined as the likelihood that one would favorably recommend a firm's product" (Maxham, 2001).

It's a person to person communication with positive and negative reviews. WOM may be divided into Positive Word of Mouth/Altruism (PWOM) & Negative Word of Mouth (NWOM). ALTRUISM/PWOM is the act of doing something for others without anticipating any reward in return (Sundaram, Mitra and Webster,

1999). Positive WOM consists of favorable experiences with products and buying recommendations. It seems coherent that the consumer will evaluate an environmentally sustainable innovation carefully before recommending it.

PWOM/Altruism can be recognized/ identified as a significant driver /most credible way of transmitting information from an existing customer to potential customers. PWOM here refers to the likelihood that respondents will recommend the product or service to a friend (Maxham, 1999). Therefore it is quite natural to think that a satisfied customer of SPV will definitely spread PWOM as it is an innovative sustainable renewable solution for power crisis.

4.12.4 Summary

Table No. 4.2

Confirmed List of Variables for Customers Questionnaire

Research Variables	Latent Variable	Observed Variable
Research Variable APB	**Awareness**	Green energy product
		Reduction in KSEB electricity
		On-grid
		Changing Battery
		Cost of battery replacement
		Charging
		Working under power cut
		2KW scheme
		changing to on-grid
		SERC order
		Availing SERC reduction
		Government Policy
		Procedure for changing
		Battery backup for on-grid
		Hybrid solar
	Economic	Consideration of ROI

		Less operational cost
		Minimum maintenance
		Competitive
		Save predictable energy cost
		Reduction of electricity bill
		Adds value to property
		Affordable technology
		Adopt without subsidy
		Adopt because of subsidy
	Environmental Attitude (Relative Advantage)	Better quality of life
		Sustainable product
		Reducing pollution
		Safe electricity
		Silent operation
		Environmental awareness
		Reduce impact of eco system
		Green path of development
		Reduce green house gas
		Prevent global warming
		Reduce carbon footprints
	BSR	Energy security
		Eliminate energy poverty
		Unlimited source
		Reduction of nuclear fuel
		Achievement of MDG
		Saving on conventional
		Reduced T&D
		Compatible
		Comprehensive solution
	Perceived Usefulness	Reduction in electricity
		Conventional fuel saving

		Peak time consumption
		Uninterrupted power
		Protection from raising
		Power breakdown
	Attitude towards Government Initiative	Mandatory in future
		Mandatory
		Rooftop scheme effective
		Joint effort
		Government rules
		Solar connect
		Awareness programmes
	Peer Influence	Friends
		Colleagues
		Family
		Prestige
Research Variable 1 Satisfaction	**Product**	Quality of panel
		Quality of inverter
		Quality of battery
		Can meet requirement
		Working equipments
		Battery capacity
	Price	Reasonable price
		Monthly installment
	Communication	Information about filling
		Informed about on-grid
		Cleaning of panels
		Better customer support
		Promotional activities
	Distribution	Accessibility of company
		Accessibility of dealers
		Availability of components

		Overall satisfaction
	Ease of use	Difficulty in switch over
		Difficulty in filling water
		Use without frequent failure
		Usage experience
	SQ	Timely installation
		Satisfaction with installation
		Delay in service
		Credibility of providers
		Monitor system
Research Variable 2 CAI (Continued Adoption Intention)		Intention to stick on this technology in future
		Intention to adopt the related technology in future (Further Capacity Addition)
Research Variable 3 Repeat Purchase Behaviour (RPB) / Further adoption		Consider further adoption
		Change to on-grid
		Willing to pay premium
Research Variable 4 (PWOM) Positive Word of Mouth		Recommend solar power plant to others
		say positive things about this product
		If somebody asks any kind of recommendation about this product, I will recommend this product

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CHAPTER 5

MODELLING ANTECEDENTS AND CONSEQUENCES OF DOMESTIC OFF-GRID RTPV ADOPTION BEHAVIOUR

CHAPTER 5

MODELLING ANTECEDENTS AND CONSEQUENCES OF DOMESTIC OFF-GRID RTPV ADOPTION BEHAVIOUR

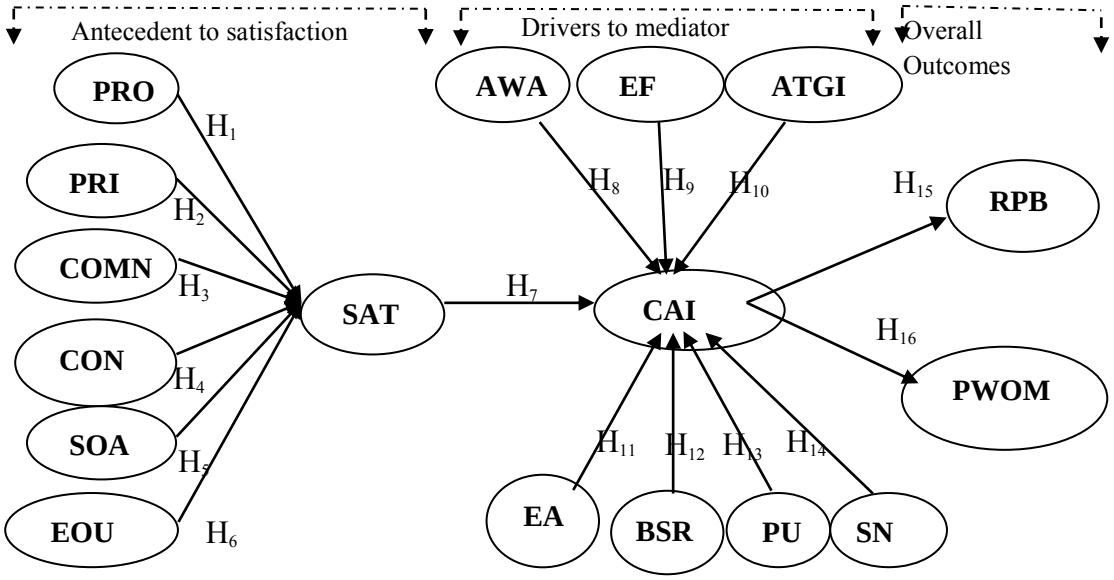
5.1 Chapter Overview

In this chapter the researcher discusses the details about the data analysis and its results, and subsequently presents the results of hypotheses testing. Overall, the data analysis of the study is presented in four major sections.

In the first section, the chapter discusses the basic demographic characteristics of the sample respondents. In addition, this section also elaborates the basic descriptive statistics related to other relevant psychographic aspects measured during the measurement. Followed by this, in section two, the researcher discusses the preliminary check of the psychometric properties of the scales used to measure the proposed dimensions. As part of this preliminary check, first the study analysed unidimensionality of the scale dimensions through a series of Exploratory Factor Analyses (EFA). In this section, the study also assessed the reliability of the scale dimensions through Cronbach's Coefficient Alpha. Further, in section three, the researcher elaborated the results of validity and reliability checks, which was conducted through a series of Confirmatory Factor Analyses (CFA). In this stage, the researcher mainly analyses the convergent, discriminant validity of the scale measures, and also confirmed the reliability through composite reliability measure. In section four of the chapter, the researcher examined the goodness of fit of the conceptual model, and subsequently tested the proposed set of hypotheses and the hypothesized framework (See Figure 5.1 for hypothesized framework).

Figure No. 5.1

Conceptual Framework Showing the Study Hypotheses



Note: SAT= Satisfaction, PRO=Product Oriented Aspects, PRI=Price Oriented Aspects, COMN=Communication, CON=Convenience, SOA=Service Oriented Aspects, EOU=Ease of Use, AW=Awareness regarding RTPV, EF=Economic Factors, ATGI=Attitude towards Government Initiatives, EA=Environmental Attitude/ Relative Advantage, BS= Buyer Social Responsibility, PU=Perceived Usefulness, S=Subjective Norms, CAI=Continued Adoption Intention, RPB= Repeated Purchase Behaviour, PWOM=Positive Word of Mouth.

SECTION ONE

5.2 Demographic Profile of the Respondents

In this first section, demographic profile of the respondents with respect to their gender, age, education, occupation, income and area is analysed and presented. This is basically to examine and understand the pattern and tendencies of these demographic characteristics. For example, there may be differences in young and older generation towards the perception and adoption of a green technological product. Similarly, gender-wise comparison is also found to be necessary. The level of education may have an impact on the knowledge of the benefits of RE in the society. Likewise people may think rationally for the SPVPP adoption as it is a high investment product. Occupation and income-wise classification are also imperative because it implies the credit worthiness of persons to opt for the product which needs a high capital outlay and long payback period. Hence, it is necessary to get an idea about the demographic profile of SPVPP consumers in Kerala. The following Table 5.1 depicts the information regarding demographic profile of the sample respondents

Table No. 5.1

Demographic profile of the Sample RTPV consumers in Kerala

Variables	Parameters	Frequency	Percentage
Gender	Male	281	89.2
	Female	34	10.8
	TOTAL	**315**	**100**
Age	20-30 Years	6	1.9
	31-40 Years	33	10.5
	41-50 Years	53	16.8
	Above 50 years	223	70.8
	TOTAL	**315**	**100**
Qualification	Undergraduate	37	11.7
	Graduate	85	27
	PG	53	16.8
	Diploma	16	5.1
	Professional	124	39.4
	TOTAL	**315**	**100**

Occupation	Government sector	111	35.2
	Business	60	19
	Private Sector	59	18.7
	Profession	85	27
	TOTAL	**315**	**100**
Monthly Income	Below Rs.20000	40	12.7
	Rs.20000- Rs.30000	70	22.2
	Rs.30000-Rs.40000	43	13.7
	Rs.40000-Rs.50000	30	9.5
	Above Rs.50000	132	41.9
	TOTAL	**315**	**100**
Area	Corporation	168	53.3
	Municipality	47	14.9
	Panchayat	100	31.7
	TOTAL	**315**	**100**

Source: primary data

The breakup of the demographic profile of the RTPV consumers of Kerala with regard to gender, age, education, occupation, income and area is shown in Table 5.1. Results revealed that out of 315 respondents, 89.2 per cent of the respondents were male, and 10.8 per cent were female. From the Table it is seen that 70.8 per cent belonged to 50 years and above category, followed by 16.8 per cent respondents who were in the age group of 41-50 years,10.5 per cent belonged to the age group of 30 -40 years, and the remaining contributing to 1.9 per cent from the age group of 20-30 years. The data of the respondents' educational qualifications is also reflected in the Table. A majority of the respondents from professional degree holders contributing 39.4 per cent followed by graduates, postgraduates, undergraduates with 27 per cent, 16.8 per cent, and 11.7 per cent respectively. The remaining respondents comprised 5.1 per cent of diploma holders. As far as occupation was concerned, a majority of the respondents are from government service, who comprised 35.2 per cent, followed by professionals, comprised of 27 per cent from the total population. 19 per cent were running their own business and the rest 18.7 percent were employed in the private sector. With regard to monthly income, 41.9 per cent were having a monthly income of above Rs. 50000, 22.2 per

cent ranging from Rs. 20000 to Rs. 30000, 13.7 per cent from Rs. 30000 to 40000, 12.7 per cent were earning less than Rs.20000 and 9.5 per cent from Rs. 40000 to 50000 income group. Further, an area- wise classification shows that a majority of the respondents, 53.3 per cent, were from corporation area, followed by 31.7 percent from panchayat area, and 14.9 per cent from municipal area. In short, the demographic profile analysis implies that the majority of the selected RTPV consumers from Kerala were male respondents, coming under the category 50 years and above. With regard to age, approximately three fourth of the sample RTPV consumers belong to 'Above 50 years' category and this fact points out that, old people are aware and interested in green energy technologies while there must be an awareness among younger generations about the adoption. In this, the majority of the respondents belong to the high income category, with professional education. This demographic profile which supports (Rai V and McAndrews, 2008), (Liza & Latz, 2012), (Delafrouz et al., 2014), (Keriri, 2013), (Labay, 2014) reveals that PV adopters belong to more educated and high income category and possess higher occupational status. Obviously, high income segments are the most potential target market for the product because of its high cost. However, it doesn't imply that the use of RTPV declines with decrease in monthly income. Academic elites will come as target segment because of the high involvement nature of the product. RTPV users are from government sector, followed by professionals. Furthermore, most of the selected respondents in this study were from urban and suburban area. However, there seems to be an almost equal distribution of income indicating that RTPV is accessible, irrespective of income. It can also be concluded that rural area would have more potential because of frequent power interruption.

5.3 Characteristics in terms of Possession of SPV & SWH

In solar energy products, the major classification is solar photovoltaic (from light energy) and thermal technology (heat energy). Widely recognized domestic used solar energy products are SPV from photovoltaic sector and SWH from thermal energy products. Therefore, it seems to be important to know the possession wise analysis of these products among consumers. Table 5.2 shows the system possession wise classification of the selected sample respondents

Table No: 5. 2

Possession of SPV & SWH

Sl. No	Solar energy products	Frequency	Per cent
1	SPV alone	178	56.5
2	SPV & SWH	137	43.5
	TOTAL	315	100

Source: primary data

It is inferred from Table 5.2 that 178 (56.5 per cent) out of 315 RTPV sample consumers owned SPV system while 137 (43.5 per cent) consumers owned both SPV and SWH system. Therefore, it is noticed from the Table that, there may be chances for usage of one solar energy product may lead to adopt an innovative product from the same technology. This is consistent with the previous studies (Arkesteijn & Oerlemans, 2005) which found that higher level of basic knowledge of RE displayed in the past found to increase the likelihood of adoption of new technology. It can be concluded that if the respondents have experienced green technology product, they seem to adopt new green technologies.

5.4 Characteristics in Terms of Years of usage

In this section, the respondents are asked about the duration they experienced with SPV usage.

Table No: 5.3

Years of usage

Years	Frequency	Per cent
1	18	5.7
2	105	33.3
3	170	54
4	18	5.7
>5 years	4	1.3
TOTAL	315	100

Source: Survey data

Table 5.3 reveals the information regarding the experience in the usage of SPV that 5.7 per cent, 33.3 per cent, 54 per cent, 5.7 per cent, and 1.3 per cent respondents having an experience of SPV system for 1,2,3,4 and 5 years respectively. Therefore it is clear that a majority of the respondents (54 per cent) owned SPV system for three years followed by (33.3 per cent) for two years and 5.7 per cent for one year. The remaining (5.7 per cent and 1.3 per cent) showed an experience of four and five years because of the fact that they may have adopted an SPV system earlier than adopting SPV through 10000 solar rooftop scheme.

5.5 Usage of Electric Inverter

According to Energy Management Centre (EMC) study, 20 lakh houses have inverters in Kerala (R.V.G, 2014) which are high energy wastage equipment. Table 5.4 provides information on whether the respondents had used inverter before adopting SPV system. It is an indication of the inverter users shift to RE technology because a transfer from the non-conventional energy which is very appropriate now a days.

Table No: 5.4

Usage of Electric Inverter

Inverter usage	Frequency	Per cent
Inverter users	225	71.4
Non inverter users	90	28.6
Total	315	100

Source: primary data

It was observed from Table 5.4 that 71.4 per cent of the respondents used electric inverter before doing SPV installation while 28.6 per cent were not used. Therefore, a majority of the respondents shifted green energy technology from conventional is a good indication towards the changing perception of people towards RE technologies.

5.6 Capacity of SPV Systems

Normally in '10000 solar rooftop power plant programme', the system capacity is limited to 1KW for residential customers. The following table gives information on the system capacities owned by sample respondents.

Table No: 5.5

Capacity of SPV Systems

System Capacity	Frequency	Per cent
1KW	297	94.3
Above 1KW	18	5.7
Total	315	100

Source: Survey data

Table 5.5 disclosed that 94.3 per cent sample RTPV consumers owned a system of 1KW capacity and 5.7 per cent owned a system of more than 1KW capacity**.** It can be noted that most of the beneficiaries adopted the offer as the scheme provided, as it is the first trial. So there may be chances for capacity additions if they are satisfied with the product performance.

5.7 Monthly Output of the System

As per ANERT directives, 1KW system would be able to provide 4 units of electricity in a sunny day. So roughly this system can save 120 units of electricity in a month. The Table 5.6 provides the information regarding actual monthly output of SPV system owned by the sample respondents**.**

Table No: 5.6

Monthly Output of the System

Monthly Output	Frequency	Per cent
Up to 50 units	44	13.98
51 to 100	214	67.93
Above 100	57	18.09
Total	315	100

Source: Survey data

As shown in Table 5.6, 13.97 per cent out of the 315 sample RTPV consumers are of the opinion that they had received less than 50 units. 67.94 per cent belong to 51 to 100 units while 18.09 per cent fall in above 100 unit category. So it can be inferred that the consumers wouldn't get 120 units monthly as offered by the authorities. A significant variation in the actual output can be seen and this will indicate that the system performance varies, depending on external or internal factors. This is similar with the finding (Buragohan, 2012) that, there exists a variation in the functionality in different states according to season.

5.8 Consumers perception regarding Payback period of SPV

Payback period refers to the period with in which the invested amount can be recovered.

Table No: 5. 7

Consumers perception regarding Payback period of SPV

Monthly Output	Frequency	Per cent
Up to 10 years	158	50.16
11 to 20 years	109	34.60
20-30 years	36	11.43
Above 30 years	12	3.81
Total	315	100

Source: Survey data

It was observed from Table 5.7 that 50 per cent of the sample RTPV consumers were of the opinion that payback period for their system would be 10 years.34.61 per cent respondents were of the opinion that it would take 11 to 20 years. Likewise, 11.54 per cent perceived it as 20-30 years and 3.85 percent views it as above 30 years. It can be observed from the table that no one adequately calculated the PB and they just mentioned their perception regarding PB. It is contradictory to the findings of (Rai & McAndrews, 2008), that payback period is used by majority of adopters for evaluating the financial benefits of PV. Here, the result implies that a majority of the respondents were not aware of the financial metrics or they didn't take effort to calculate it. It indicates that most of the consumers are not bothered about the cost benefit factors**.**

5.9 Preference of On-grid and Off-grid Solar

SPV may be divided into on-grid and off-grid solar. Off-grid solar means system with storage facility to store the generated electricity during daytime when it is not used or produced more units than needed. On-grid refers to grid connected solar system or we can export the generated electricity to the grid and we can import when it is needed. Even though this study includes only off-grid system users, the respondents are asked about their preferences for each type. In future there may be chance for on-grid system adoption because government a scheme for on-grid solar rooftop which is slowly progressing in its first phase**.**

Table No: 5.8

Preference of On-grid and Off-grid Solar

Types	Mean	S.D.
On-grid	3.7124	2.89301
Off-grid	4.2549	3.30232

Source: Survey data

The result of analysis on the basis of on-grid and off-grid preference is presented in Table 5.8. It can be noted from the Table that preference is for off-grid by the respondents as it has got the highest mean score of 4.2549 with a S.D of 3.30232 followed by on-grid with a mean score of 3.7123 and S.D of 2.89301.But it should be kept in mind that on-grid doesn't work during power cut. Further, when considering the electricity consumption of consumers in Kerala, it shows an average trend in 6pm to 10 pm. Therefore back up is essential for storage of electricity. Hence, the people, especially domestic consumers who adopted on-grid also need to install a small back up for storing electricity during night time use. Here, the necessity of the hybrid system combination of both (On-grid and Off-Grid) arise. Before that, the requirements of the consumers should be assessed for deciding the system type and size.

5.10 Details of Electricity Consumption

The respondents were asked about their monthly electricity consumption directly. After collecting data, the by-monthly electricity consumption divided in to

three categories using quartile deviation. The information regarding electricity consumption of SPVPP consumers in Kerala was found by categorizing the monthly electricity usage into low (<240 units), moderate (240 to 510 units) and high (>510 units).

Table No: 5.9

Details of Electricity Consumption

Electricity Consumption	Frequency	Per cent
Low	222	70.48
Moderate	73	23.17
High	20	6.35
Total	315	100

Source: Survey data

Out of 315samples RTPV consumers, almost 70.4 per cent belong to low consumption category that is their monthly electricity consumption is below 240 units, followed 23.17 per cent belonging to medium electricity consumption that is between 240 and 510 units and only 6.35 per cent belong to high electricity consumption category that is more than 510 units. This indicates that SPVPP adoption is independent from electricity usage.

5.11 Electricity Tariff

The information regarding electricity tariff of SPVPP consumers in Kerala was found by categorizing the bi-monthly electricity tariff into low (> Rs.2902), medium (Rs.2902 to Rs. 5700) and high (< Rs.5700) by using quartile deviation.

Table No: 5.10

Electricity Tariff

Electricity Tariff	Frequency	Per cent
Low	281	89.21
Moderate	26	8.25
High	8	2.54
Total	315	100

Source: Survey Data

Out of the 315 sample RTPV consumers, 89.16 per cent have a tariff rate of below Rs.2902/ which constitutes low tariff category, followed by 8.43 per cent

belonging to medium tariff category which is between Rs.2902/- and to Rs. 5700/- and only 2.41 percent included in high tariff category that is above Rs.5700/-

5.12 Electricity Consumption per Day

The information regarding per day electricity consumption of SPVPP consumers in Kerala was found by categorizing per day electricity consumption into low (<9 units), medium (10-17 units) and high (>17 units) by using quartile deviation.

Table No: 5.11

Electricity Consumption Per Day

Electricity Consumption Per Day	Frequency	Percent
Low	251	79.68
Moderate	56	17.78
High	8	2.54
Total	315	100

Source: Survey data

The Table 5.11 gives a brief description about the per day electricity consumption of the sample RTPV consumers. A majority of the sample RTPV consumers that is nearly 79.63 per cent with an absolute figure of 251 fall under the low category with less than 9 units per day electricity consumption. There were 17.9 per cent respondents with an absolute figure of 56 belong to medium per day electricity consumption category with the usage of 10-17 units per day. And only 2.47 per cent with an absolute figure of 8 belong to high per day electricity consumption with more than 17 units per day electricity usage.

5.13 Phase Connection

Power supply system classification can be single phase and three phase. Normally, single phase connection provideds for lower load or power requirement whereas three phase is needed for higher load power requirements. Three phase carries more power than single phase economically and has more efficiency with minimum loss. Generally, phase connection may have an impact on the size of the solar system installation.

Table No: 5.12

Phase Connection

Phase Connection	Frequency	Per cent
Single Phase	131	41.59
Three Phase	184	58.41
Total	315	100

Source: Survey data

5.14 Maintenance Charges per Year

As SPV is an innovative RE product, it involves some technological features. The system consists of solar panels array, PV array support structure, protective devices and cable. Normally SPV is considered as free from regular maintenance. However, expense might rise if any damage is caused to these components or for its upkeep up like filling of water in batteries, and cleaning of panels are required to maintain their efficient performance. Also installation related additional expenses may also arise. Therefore, in this section customers are asked about their yearly maintenance charges they had incurred for SPV.

Table No: 5.13

Maintenance Charges per Year

Maintenance Charges	Frequency	Per cent
Up to 500	224	71.11
500-1500	64	20.32
1500-2500	3	0.95
Above 2500	24	7.62
Total	315	100

Source: Survey data

A glance at the yearly maintenance charges incurred for the sample RTPV consumers indicated that 71.5 per cent of them pay up to 500 Rupees per year. Next to this, 20.20 per cent of them pay Rs. 500 to 1500 per year. Much fewer number of consumers (less than 1 per cent) Rs. 1500 to 2500 per year. Finally, it was also reported that around 8 per cent of them pay above Rs. 2500 as yearly maintenance charges.

SECTION II

In this section, the researcher conducted a series of analyses to examine the dimensionality and reliability of the scale measures. As part of dimensionality examination, the study conducted three different Exploratory Factor Analyses (EFAs). In the first EFA, the study included the items used to measure product oriented aspects (PRO), price oriented aspects (PRI), Communication (COMN), Convenience (CON) Service Oriented Aspects (SOA), and Ease of Use (EOU). In the second EFA, the study included the measures covering Awareness regarding RTPV (AW), Economic Factors (EF), Attitude towards Government Initiatives (ATGI), Environmental Attitude / Relative Advantage (EA), Buyer Social Responsibility (BS), Perceived Usefulness (PU), Subjective Norms (S) and Continued Adoption Intention (CAI). Finally, the third set of EFA was conducted using those items covering Repeated Purchase Behaviour (RPB), and Positive Word of Mouth (PWOM). In addition, in this stage the study examined the reliability of the scales by checking internal consistency measure using Cronbach's coefficient alpha. All the results generated in this stage are elaborated in the following sections.

5.15 EFA One: Antecedents to Satisfaction

The first EFA was conducted with thirty items covering seven dimensions. The objective of this EFA was to examine the dimensional structure of these seven dimensions. Thus, the study used Principal Component Analysis (PCA) using varimax rotation. The analysis results supported that there exists sufficient correlation between the proposed set of items, that was evident from the KMO measure (KMO = 0.801) and the Bartlett's test of sphericity (Bartlett's test = 123.67, $p < 0.01$). Further, the analysis factor structure revealed a seven dimensional factor structure, and explained a total variance of 72.12 per cent of the variance. Further, the analysis of rotated factor loading matrix (see Table 5.13) revealed that in all the seven dimensions, the items proposed to capture the dimensions were exactly loaded into the respective factors. Moreover, no issues of cross-loadings were reported. All the items loadings were highly loaded and were above the recommended threshold level of 0.50. In addition, the examination of the reliability of the proposed constructs using Cronbach's Coefficient Alpha supported that all the scale dimensions are reliable or relatively free from random measurement error.

Satisfaction Regarding RTPV

Satisfaction is recognized as a vital factor for the success of the product and indirectly it could affect the economic returns of the company by way of increasing profitability through higher market share due to PWOM and repurchase intention. It is the emotional state of the consumers after exposure to a particular product or service which leads to either loyalty or discontinuance towards that product or company depends the nature of favourable or unfavourable experience he/she received. It is recognized that to retain the existing customers is more cost - effective than attracting new customers. There are many factors which contribute to improved user satisfaction. It should be noted that 4ps linkage with satisfaction is a traditionally theoretically grounded construct. Therefore in this research, the researcher identified totally six dimensions namely, 4ps, EOU, SQ as the main determinants to explain the construct user satisfaction.

Table No: 5.14

EFA for the antecedents to satisfaction

Item No.	Items	Factor Loadings	Cronbach's α
	Product Oriented Aspects (PRO)		0.81
PRO_1	I evaluate the quality of product as good	0.77	
PRO_2	The company provides a good quality products	0.88	
PRO_3	The company provides good quality of battery	0.8	
PRO_4	Present installed capacity of the product is enough for meeting my electricity requirements.	0.79	
PRO_5	Receiving enough electricity for working all my equipment as I expected	0.71	
PRO_6	Present battery capacity is enough for RTPV system.	0.77	

	Price Oriented Aspects (PRI)		0.79
PRI_1	Reasonable price for the system	0.81	
PRI_2	Monthly Installment system will make this solar system more popular	0.78	
	Communication (COM)		0.82
COM_1	Detailed information about filling of water in batteries.	0.67	
COM_2	Informed about on grid system	0.71	
COM_3	Information regarding cleaning of panels every three months.	0.67	
COM_4	Better customer support from my SPVPP company	0.73	
COM_5	Doing enough promotional activities about solar energy system	0.71	
	Convenience (CON)		0.77
CON_1	Accessibility of company in own district	0.82	
CPM_2	Availability of authorized dealers of the company	0.68	
CON_3	Availability of components/spare parts	0.69	
	Service Oriented Aspects (SOA)		0.83
SOA_1	Timely installation of the system	0.76	
SOA_2	Satisfied with the installation work done by the company	0.69	
SOA_3	No delay in getting service whenever I called the company.	0.61	
SOA_4	No failure after installation	0.77	
SOA_5	Company will monitor RTPV system every 6 months.	0.75	

SOA_6	Assurance about the credibility of RTPV providers	0.76	
SOA_7	Not incurred any additional expenses for installing RTPV system.	0.76	
SOA_8	It will be better if the maintenance services are every 6 months	0.71	
SOA_9	Company will take responsibility of reinstallation after 20 years.	0.67	
	Ease of Use (EOU)		0.77
EOU_1	No difficulty in switch over from solar to grid electricity	0.88	
EOU_2	No difficulty in filling water in battery	0.78	
EOU_3	Use of RTPV without frequent Failure after installation	0.82	
EOU_4	Good usage experience with RTPV	0.81	
	Satisfaction(SAT)		
SAT_1	Satisfied with RTPV (Overall Satisfaction)	0.78	

Note: KMO = 0.801, Bartlett's test = 123.67, $p < 0.01$.

Product Related Factors

As reported in table 5.14, Product quality is one of the important determinant of consumer satisfaction. It is the consumer's judgment of the overall excellence or superiority (Bei et al., 2001). Here it indicates the quality of performance of products components. Empirical results showed a direct and indirect and mediation effect of Product quality with satisfaction, PI and PWOM. Marketers introduce value added features for making the product unique from competitors. The researcher used 6 items on a five point scale to measure this dimension. The results of factor loading matrix supported that all these items intended to capture POA dimension were exactly loaded into the factor and all of them reported high factor loading. The reliability index also supported the scale reliability ($\alpha = 0.81$).

The second factor extracted in the factor structure matrix is price. Price is perceived as a sacrifice made by the consumers for receiving a benefit. It is evaluated in the cognitive conception of consumers and direct or indirect link with consumer satisfaction. If it is perceived fair or reasonable, they may not be dissatisfied. Here the respondents are asked about the fairness about price charged by the company and mode of payment. The two statements used for measuring price loaded highly to the factor. Croanbach alpha shows values higher than satisfactory limit. ($\alpha = 0.79$).

The third factor, Promotion is one of the critical aspects in marketing success of a product. It is termed as communication when viewed from customer side. Communication must be a two way process in which we are making sure that consumers are aware or updated with the features and latest information about the product. As satisfaction regarding this aspect is necessary therefore Proper communication should ensure an upward trend in sales, market share, brand recognition, inform and educate about a particular product and create a competitive market. Here communication aspects indicate the necessary requirements to keep the system damage free must be communicated clearly to a customer as it is a technological product. So a customer may look for the detailed instructions for its efficient functioning and latest updates. Topping of distilled water on batteries and cleaning dust on panes are necessary for its improved life cycle and efficient functioning. The factor loading matrix supported that the five statements used to capture communication were exactly loaded in to that dimension and reported high factor loadings. Internal reliability statistics of the items passed the excellent benchmark. ($\alpha = 0.82$).

The next factor is convenience describes the accessibility of company, suppliers, products, and components. This factor becomes more important for a high involvement product as the consumers who had purchase intention demotivated by lack of availability, inconvenience. The three variables which were used to measure CON received adequate support for the dimensionality. Furthermore, all the items shows a high loading in to the factor. Reliability check shows a supporting value ($\alpha = 0.77$).

EOU is the individuals assessment of effort involved in the process of using the system. If consumers can operate and use a system without much effort, it is more

likely to increase the product acceptance and satisfaction. Furthermore it would also increase self efficacy which also may lead to satisfaction. It should be noted that further purchase intention and behaviour can be predicted by EOU. Moreover, EOU played a prominent role in innovative technology acceptance. TAM model also recognizes EOU as fundamental requirement which determines one's behaviour intention and behaviour to use technology. 'Complexity' dimension of DOI theory of Rogers also states that the system complexity will negatively affect the usage of the system. 'Research in Psychology and marketing has also suggested that perception became more specific after direct experience.'(Venketesh & Davis, 1996). They suggested that "subjects without direct experience in a given domain base their perception on abstract criteria, and after direct experience, can make their judgement based on more concrete criteria." In this section, difficulty in switchover from solar to grid electricity, filling water in battery, usage without frequent failure and overall usage experience are considered as the determinants of EOU. Therefore understanding the satisfaction regarding these antecedents of EOU seems to be relevant in practical point of view because the perceived difficulty to use a system may be the underlying reason for adopting and using a technology. Four variables were used to measure EOU. The factor loading matrix revealed all the items loaded above the suggested threshold. The results of Reliability show that Croanbach alpha coefficient ($\alpha = 0.77$) proves that its reliable.

SOA indicates that consumers overall assessment regarding the inferiority and superiority of the service provided by the company could have a greater effect on satisfaction and subsequent behaviour. 'SQ dimension may vary on the basis of service type' (Ganesan-Lim, Russell-Bennett & Dagger, 2008). As it is an innovative technological product, assurance is the most important dimension provided from the part of suppliers. Hence four statements regarding assurance and one statement from each dimension of SQ model proved to be highly loaded into the SOA dimension by the factor loading structure.($\alpha = 0.83$).

5.16 EFA two: Antecedents to Mediator

In this second set of EFA, the study performed Principal Component Analysis using the items used to measure the seven dimensions. All these dimensions were

proposed as antecedents to the proposed mediator, continued adoption intention (CAI).

The EFA results supported the inference that there exists sufficient correlation between the study items (KMO = 0.81, Bartlett's test of sphericity = 143.22, $p < 0.01$), indicated that the data collected are adequate to perform EFA. Further, in support of theoretical proposition, the analysis of factor loading structure revealed seven factor structures.

Table No. 5.15

EFA on Antecedents to Mediator

Item No.	Items	Factor Loadings	Cronbach's α
	Awareness (AW)		**0.82**
AW_1	Green energy product	0.77	
AW_2	Reduction in Electricity use	0.76	
AW_3	cost saving	0.71	
AW_4	Awareness about On-Grid solar system	0.67	
AW_5	SPV is a sustainable energy saving product	0.43*	
AW_6	Aware about changing battery after 5 years of installation at the time of purchase	0.8	
AW_7	Approximate cost of battery replacement.	0.29*	
AW_8	No further charge is possible if battery charge reached 100%.	0.77	
AW_9	On-grid system will not work during power cut.	0.76	
AW_10	Aware about 2KW on-grid solar system scheme	0.65	
AW_11	Inverter change in case of off grid to on grid conversion	0.34*	
AW_12	capital subsidies for solar system	0.28*	
AW_13	SERC order about exemption of Rs 1 For monthly electricity bill for 1 kw owners	0.61	
AW_14	Requirements for getting SERC reduction.	0.59	
AW_15	Net metering facility for on grid system	0.67	
AW_16	Feed in tariff for solar energy	0.67	
AW_17	Solar energy policy of Government and mandatory installation of solar for houses having more than 2500sq ft.	0.66	

AW_18	Procedures for getting grid connection	0.67	
AW_19	Small battery back- up needed for uninterrupted working of on-grid system during the time of power cut	0.78	
AW_20	Hybrid solar system.	0.76	
	Economic Factor (EC)		0.78
EC_1	Decision of installing solar system by considering Return On Investment (i.e. breakeven period/payback period)	0.83	
EC_2	Less operational cost	0.81	
EC_3	Minimum maintenance	0.83	
EC_4	Solar energy would be even more competitive if external costs from fossil fuel were taken into account	0.69	
EC_5	Safe from the rising trend of electricity cost in future	0.71	
EC_6	Reduced of electricity bill	0.77	
EC_7	Adds value to property	0.68	
EC_8	Solar system is an Affordable technology without subsidy.	0.71	
EC_9	I would have been adopted solar even if there had been no subsidy	0.68	
EC_10	Adopted solar because of government Subsidy/Incentives	0.41*	
	Attitude Toward Government Initiatives (ATGI)		0.77
ATGI_1	Solar system will become mandatory in future	0.81	
ATGI_2	Govt. has made mandatory installation of solar in various custumers categories.	0.82	
ATGI_3	10000 rooftop programme of ANERT was effective	0.72	
ATGI_4	Joint effort of KSEB and other government agencies with ANERT	0.77	
ATGI_5	Strict government rules and regulations across the world	0.81	
ATGI_6	“Solar connect” scheme for on-grid is a better option	0.82	
ATGI_7	ANERT is effective in conducting awareness programs	0.77	

	Perceived Usefulness (PU)		0.81
PU_1	To reduce Electricity bill	0.77	
PU_2	Conventional fuel saving		
PU_3	Peak time consumption reduction	0.76	
PU_4	Reduction in number of working hours due to power breakdown	0.79	
PU_5	We want Uninterrupted power supply	0.69	
PU_6	Protection against raising trends of fossil fuel energy	0.71	
	Environmental Attitude(EA)		0.69
EA_1	Help people to have a better quality of life.	0.78	
EA_2	To meet expectation for sustainable products	0.76	
EA_3	Helps Improving public health by reducing pollution	0.75	
EA_4	Can produce our own clean and safe electricity	0.66	
EA_5	Working of the system has silent operation (No noise pollution)	0.62	
EA_6	Demonstration of environmental awareness and responsibility	0.41*	
EA_7	Reduce the impacts on ecosystem caused by the extraction transportation, processing and use of fossil fuels	0.76	
EA_8	To be a part of green path of global economic development	0.81	
EA_9	Reduce of GHG	0.75	
EA_10	Preventing global warming impacts by changing into solar energy.	0.34*	
EA_11	Reduce carbon footprint	0.76	
	Buyer Social Responsibility (BS)		0.71
BS_1	Enhance energy security at global, national and local level	0.77	
BS_2	An important role in eliminate energy poverty	0.72	
BS_3	Unlimited source of energy	0.32*	
BS_4	Reduces India's Reliance on Alternate Sources of Energy such as Nuclear Fuel from other countries	0.67	

BS_5	Reduces India's dependence on Risky sources of Energy Sources (Eg: Radiation Risk, Explosion Risk)	0.68	
BS_6	MDGs could be achieved by utilizing solar energy	0.71	
BS_7	Savings on expenses of new conventional power plants	0.72	
BS_8	Reduced investments in transmission and distribution infrastructure	0.77	
BS_9	Reducing rural energy poverty	0.8	
BS_10	Compatible with modern living	0.81	
BS_11	Comprehensive solution for electricity	0.76	
	Subjective Norm (SN)		0.72
SN_1	Adopted solar by friends encouragements and support	0.76	
SN_2	Adopted solar by colleagues encouragements and support	0.75	
SN_3	Adopted solar by families encouragements and support	0.81	
SN_4	Adopted solar because of prestige for capability of generating own electricity	0.82	

Note: * shows items deleted due to low loadings.

As reported in Table 5.15, the first factor, Awareness (AW) describes the users' cognition concerning the present technology, its benefits, awareness related to various aspects and updates of current technology. To measure this dimension, the researcher used 20 items on a five point scale. Higher level of basic knowledge of RE displayed in the past found to increase the likelihood of adoption of new technology (Arkesteijn & Oerlemans, 2005). Further Keriri, (2013), revealed that increase in the knowledge and awareness would lead to increase in adoption. Government is striving to achieve the ambitious targets by adequate policy interventions, like net metering, feed in tariffs. It is a new concept in India, but successfully implemented all over the world, especially in Australia, Canada, Italy, Spain, Denmark and the US. RTPV is a micro generation technology which can be used for decentralized applications. Consumers showing interest in adopting this technology, while at the same time, they may have lack of knowledge about the basic features of the system. That is it can be two types.1) solar rooftop system with storage/ battery capacity (off-grid) and 2) grid

connected solar rooftop system (on-grid). Sufficient knowledge about the functioning of the adopted system is necessary to make a trade off between the benefits and drawbacks of each type of system and to achieve satisfaction. Thirteen states have already notified policies for the promotion of rooftop solar and net metering facility available for on-grid consumers in Kerala. Net metering is a billing mechanism which allows the consumers to export the generated electricity to the grid if system owners produce more than what they want during day time and can import for consumption at night when they needed. Feed in Tariff on the other hand, is also a measure related grid interactive system aimed at accelerating investment by offering long term contracts by RE generators on supply to the grid. Both these policies are meant for supporting RE deployment. The study took awareness into various dimensions like basic product features, functioning, environmental aspects, cost related matters and latest updating in supporting government policies because consumers must possess necessary knowledge in these specified matters. This will make the users more confident and can inculcate the level of acceptance about this new technological product among users. Further it will boost the confidence of existing users to recommend to other prospective consumers. In addition they can adopt the right type of system if they want capacity additions in future. An analysis has been conducted to understand the level of awareness of the users about the system by rating their awareness on 20 statements regarding SPV in various aspects on a five point scale .Furthermore, the government has already ordered a reduction of Rs.1 for units generated from SPVPP for encouraging its use. The analysis revealed that five of the items used to capture the dimensions loaded less than the suggested cut-off of 0.50. Thus, the study deleted those items from the analysis. For this factor, the analysis of reliability also supported that the scale used to measure is reliable ($\alpha = 0.82$).

The second factor extracted in the factor structure matrix is Economic Factor, which include initial cost, payback period, rising cost of other energy sources, availability of government incentives or programmes to offset installation cost, etc. From this factor loading matrix, the study found that one item (EC_10) loaded less than the suggested cut-off value of 0.50, therefore, this item has been removed from further analysis. Besides this, all the other items loaded highly into the factor. The reliability value also supported that the items used to capture the scale are reliable ($\alpha = 0.78$).

The third factor, Attitude toward Government Initiatives (ATGI) explains the overall evaluative judgement held by the people towards government initiatives. ATGI indicates the initiatives like various supporting schemes and incentives for the penetration of SPV products taken by the government. Seven variables were used to measure ATGI. The factor loading matrix supported the fact that all these seven items intended to capture the dimensions were exactly loaded into the factor, and all of them reported high factor loadings. The reliability coefficient also supported that the scale is reliable ($\alpha = 0.77$).

The next factor is Perceived Usefulness (PU), which indicates the usability of the system**.** Six variables are used to measure PU. From the EFA, the study received adequate support for the dimensionality of PU. Moreover, all the items capturing the dimensions were loaded highly into the factor. In addition, the reliability check also supported that the scale is reliable ($\alpha = 0.81$).

Environmental Attitude (EA) is the readiness to support the environment. The environmental attitude towards RTPV can be viewed as the relative advantage of this product**.** Eleven questions were used to measure EA. From the factor loading matrix, it was observed that two of the items (EA_6 & EA_10) loaded less than the suggested threshold level of 0.50. The remaining items loaded highly into the factor. In addition, the reliability coefficient also supported the reliability of the scale ($\alpha = 0.69$).

Buyer Social Responsibility (BS) indicates some kind of social involvement on the part of buyers. 11 variables were used to measure BS. The factor loading matrix revealed that one item loaded less than the suggested threshold (BS_3), and all the other items loaded above the suggested threshold. The check of reliability also supported that the scale is reliable ($\alpha = 0.71$).

The final factor the study extracted from the analysis is Social Norms (SN). SN indicates the consideration of others opinion in decision making. Four variables were used to measure SN. The factor loading structure revealed a good factor structure. Also the scale supported that it is reliable ($\alpha = 0.72$).

5.17 EFA three: for the outcome variables

Finally, we conducted a third EFA to examine the dimensional structure of the outcome variables, such as continued adoption intention (CAI), repurchase behaviour

(RPB), and positive word of mouth (PWOM). The analysis supported a good factor structure (KMO = 0.78, Bartlett's test = 321. 23, $p< 0.02$). In this factor loading structure, all the items proposed to measure the dimensions were exactly loaded into the respective dimensions. Thus, we confirmed the dimensional structure of the proposed outcome variables. In addition, for all the three factors the reliability coefficients supported the reliability of the scales. Table 5.16 provided the details about the factor loadings and the reliability measures.

Table No. 5.16

EFA on Outcome variables

Item No.	Items	Factor Loadings	Cronbach's α
	Repurchase Behaviour(RPB)		0.77
RPB_1	Consideration of further use of solar energy in future	0.67	
RPB_2	Preference to change on-grid	0.76	
RPB_3	Willingness to pay for a small battery backup for uninterrupted working of on-grid system	0.81	
	Positive Word of Mouth (PWOM)		
PWOM_1	I will recommend this product to others	0.87	
PWOM_2	I will speak positive things about this product	0.82	0.81
PWOM_3	If somebody asks for any kind of feedback about this product I will recommend this product	0.8	
	Continued Adoption Intention (CAI)		0.84
CAI_1	I will try to stick on to this technology in future	0.71	
CAI_2	I have an intention to adopt the related technology in future	0.76	

SECTION III

This section of this chapter explains the measurement model testing results performed to confirm the validity and reliability of the scale measure. This measurement model is necessary before the test of hypotheses. In this study, this measurement model testing was conducted through Confirmatory Factor Analysis (CFA). Validity explains the ability of an instrument (here the scales)to measure what the researcher intended to measure. Similarly, reliability of an instrument examines the extent of random error in the scale measures. In this stage, the study decided to perform two types of validity. First type validity called as convergent validity. This type of validity explains the extent of convergence among the items covering the respective dimension. Similarly, the discriminant validity explains the extent of divergence between the items covering the different dimensions. In this stage, the study analysed the reliability of the study measurements using a coefficient, called as Composite Reliability (CR). In the following pages, the study provided the measurement model testing Tables derived from CFA analysis and its interpretations.

5.18 Convergent validity

In this study, the researcher tested the convergent validity of the scale measures using three different measures. The first measure used is CFA factor loadings. It was recommended that if the CFA factors loadings are above 0.50 and loaded high, then it indicates the evidence of convergent validity. Further, another measure generally used by researchers to confirm the convergent validity is called as: Average Variance Extracted (AVE). If the AVE values are above 0.50 it also indicate the convergent validity of the scale measures. Finally, it is also suggested that if the CR values are above 0.50 it also informs the evidence of convergent validity. In the current study, the researcher used all these three measures for the purpose of checking the same.

Table 5.17

CFA Factor loadings and CR values

Item No.	Items	CFA Factor Loadings	Composite Reliability
	Product Oriented Aspects (PRO)		0.82
PRO_1	I evaluate the quality of product as good	0.76	
PRO_2	The company provides a good quality product	0.8	
PRO_3	The company provides good quality of battery	0.79	
PRO_4	Present installed capacity of the product is enough for meeting my electricity requirements.	0.76	
PRO_5	Receiving enough electricity for working all my equipment as I expected	0.7	
PRO_6	Present battery capacity is enough for RTPV system.	0.75	
	Price Oriented Aspects (PRI)		0.8
PRI_1	Reasonable price for the system	0.79	
PRI_2	Monthly Installment system will make this solar system more popular	0.76	
	Communication (COM)		0.83
COM_1	Detailed information about filling of water in batteries.	0.62	
COM_2	Informed about on grid system	0.7	
COM_3	Information regarding cleaning of panels every three months.	0.66	
COM_4	Better customer support from my SPVPP company	0.71	
COM_5	Doing enough promotional activities about solar energy system	0.73	
	Convenience (CON)		0.77
CON_1	Accessibility of company in own district	0.83	
CPM_2	Availability of authorized dealers of the company	0.69	
CON_3	Availability of components/spare parts	0.66	
	Service Oriented Aspects (SOA)		0.84
SOA_1	Timely installation of the system	0.75	

SOA_2	Satisfied with the installation work done by the company	0.66	
SOA_3	No delay in getting service whenever I called the company.	0.63	
SOA_4	No failure after installation	0.72	
SOA_5	Company will monitor RTPV system every 6 months.	0.74	
SOA_6	Assurance about the credibility of RTPV providers	0.75	
SOA_7	Not incurred any additional expenses for installing RTPV system.	0.76	
SOA_8	It will be better to do the maintenance services every 6 months	0.79	
SOA_9	Company will take responsibility of reinstallation after 20 years.	0.64	
	Ease of Use (EOU)		0.78
EOU_1	No difficulty in switch over from solar to grid electricity	0.8	
EOU_2	No difficulty in filling water in battery	0.73	
EOU_3	Use of RTPV without frequent failure after installation	0.8	
EOU_4	Good usage experience with RTPV	0.84	
	Satisfaction(SAT)		
SAT_1	Satisfied with RTPV (Overall Satisfaction)	0.75	
	Awareness (AW)		0.84
AW_1	Green energy product	0.73	
AW_2	Reduction in Electricity use	0.71	
AW_3	cost saving	0.71	
AW_4	Awareness about On-Grid solar system	0.67	
AW_6	Aware about changing battery after 5 years of installation	0.76	
AW_9	No further charge is possible if battery charge reaches 100%.	0.73	
AW_10	On-grid system will not work during power cut.	0.71	
AW_11	Aware about 2KW on-grid solar system scheme	0.66	
AW_14	SERC order about exemption of Rs 1 for monthly electricity consumption	0.63	
AW_15	electricity bill for 1 kw owners	0.78	

AW_16	Requirements for getting SERC reduction.	0.64	
AW_17	Net metering facility for on grid system	0.68	
AW_18	Feed in tariff for solar energy	0.63	
AW_19	Solar energy policy of Government and mandatory installation of solar for houses having more than 2500sq ft.	0.67	
AW_20	Procedures for getting grid connection	0.67	
AW_21	Small battery back- up needed for uninterrupted working of on-grid system during the time of power cut	0.73	
AW_22	Hybrid solar system.	0.75	
	Economic Factor (EC)		0.78
EC_1	Decision of installing solar system by considering Return On Investment (i.e. breakeven period/payback period)	0.83	
EC_2	Less operational cost	0.79	
EC_3	Minimum maintenance	0.83	
EC_4	Solar energy would be even more competitive if external costs from fossil fuel were taken into account.	0.66	
EC_5	Safe from the rising trend of electricity cost in future.	0.74	
EC_6	Reduced electricity bill.	0.73	
EC_7	Adds value to property.	0.64	
EC_8	Solar system is an Affordable technology without subsidy.	0.7	
EC_9	I would have adopted solar even if there had been no subsidy.	0.66	
	Attitude Toward Government Initiatives (ATGI)		0.78
ATGI_1	Solar system will become mandatory in future	0.83	
ATGI_2	Govt. has made mandatory installation of solar in various customers' categories.	0.8	
ATGI_3	10000 rooftop programme of ANERT was effective	0.73	
ATGI_4	Joint effort of KSEB and other government agencies with ANERT	0.7	

ATGI_5	Strict government rules and regulations across the world	0.8	
ATGI_6	"Solar connect" scheme for on-grid is a better option	0.84	
ATGI_7	ANERT is effective in conducting awareness programs	0.76	
	Perceived Usefulness (PU)		0.82
PU_1	To reduce Electricity bill	0.76	
PU_2	Conventional fuel saving		
PU_3	Peak time consumption reduction	0.7	
PU_4	Reduction in number of working hours due to power breakdown	0.71	
PU_5	We want Uninterrupted power supply	0.7	
PU_6	Protection against raising trends of fossil fuel energy	0.73	
	Environmental Attitude(EA)		0.7
EA_1	Help people to have a better quality of life.	0.72	
EA_2	To meet expectation for sustainable products	0.75	
EA_3	Helps Improving public health by reducing pollution	0.76	
EA_4	Can produce our own clean and safe electricity	0.64	
EA_5	Working of the system has silent operation (No noise pollution)	0.65	
EA_7	Reduce the impacts on ecosystem caused by the extraction transportation, processing and use of fossil fuels.	0.77	
EA_8	To be a part of green path of global economic development.	0.8	
EA_9	Reduce of GHG	0.77	
EA_11	Reduce carbon footprint	0.77	
	Buyer Social Responsibility (BS)		0.74
BS_1	Enhance energy security at global, national and local level.	0.73	
BS_2	An important role in eliminate energy poverty.	0.73	

BS_4	Reduces India's Reliance on Alternate Sources of Energy such as Nuclear Fuel from other countries	0.68	
BS_5	Reduces India's dependence on Risky sources of Energy Sources (eg: Radiation Risk, Explosions Risk, Spent Fuel Disposal etc)	0.69	
BS_6	MDGs could be achieved by utilizing solar energy	0.73	
BS_7	Savings on expenses of new conventional power plants	0.79	
BS_8	Reduced investments in transmission and distribution infrastructure	0.75	
BS_9	Reducing rural energy poverty.	0.82	
BS_10	Compatible with modern living	0.84	
BS_11	Comprehensive solution for electricity	0.78	
	Subjective Norm (SN)		0.73
SN_1	Adopted solar by friends encouragements and support	0.72	
SN_2	Adopted solar by colleagues encouragements and support	0.75	
SN_3	Adopted solar by families encouragements and support	0.83	
SN_4	Adopted solar because of prestige for capability of generating own electricity	0.82	
	Repurchase Behaviour(RPB)		0.78
RPB_1	Consideration of further use of solar energy in future	0.66	
RPB_2	Preference to change on-grid	0.71	
RPB_3	Willingness to pay a small battery backup for uninterrupted working of on-grid system	0.83	
	Positive Word of Mouth (PWOM)		
PWOM_1	I will recommend this product to others	0.88	
PWOM_2	I will speek positive things about this product	0.84	

PWOM_3	If somebody ask for any kind of feedback about this product I will recommend this product	0.86	0.82
	Continued Adoption Intention (CAI)		
CAI_1	I will try to stick on this technology in future	0.75	0.85
CAI_2	I have an intention to adopt the related technology in future	0.77	

As reported in Table 5.17, the examination factor loading reported that all the items measuring its respective dimensions were loaded highly into that factor. In all the cases, the factor loadings were above the suggested cut-off of 0.50. In addition, the examination of estimated CR values supported that for all dimensions the values were above the suggested cut-off of 0.50. Finally, the examination of AVE values (See Table 5.18) also supported that for all dimensions, the calculated AVE values were above the suggested threshold of 0.50. All these confirmed that the scale measures used to capture different dimensions carrying sufficient convergent validity.

5.19 Discriminant Validity

To examine the discriminant validity the study followed an important discriminant validity check procedure recommended by Hair et al (2010). In this procedure, it is recommended that if the AVE values of the dimensions are greater than the correlation square between the construct pairs it is an indication of discriminant validity. As reported in Table 5.18, the examination of AVE values with the correlation square between the constructs revealed that in all the cases the calculated AVE values were greater than the pair wise correlations. Thus, the study confirmed the fact that the scale measures used to measure different dimensions were divergent or it carried adequate level of discriminant validity.

In addition, the study also analysed the goodness of fit of the overall measurement model from the correlated CFA model. From the analysis, it was observed that the overall correlated CFA model indicated a good fit ($\chi 2$ = 1234.12, CFI = 0.90, GFI = 0.89, SRMR = 0.040, RMSEA = 0.050, TLI = 0.92). It also confirms the goodness of fit of the measurement model. All these directed the study that the scale used to measure different dimensions is valid and reliable, therefore, proceed for hypotheses testing.

Table No. 5:18

AVE, CR and correlations

	CR	AVE	MaxR(H)	PRO	PRI	COM	CON	SOA	EOU	SAT	AW	EF	ATGI	EA	BS	PU	SN	RBP	PWOM
PRO	0.846	0.658	0.921	**0.811**															
PRI	0.87	0.43	0.95	0.326	**0.656**														
COM	0.89	0.452	0.965	0.032	0.606	**0.672**													
CON	0.765	0.353	0.969	0.221	0.441	0.297	**0.594**												
SOA	0.912	0.509	0.977	0.037	0.006	0.112	0.311	**0.713**											
EOU	0.841	0.571	0.98	0.425	0.611	0.239	0.539	0.099	**0.756**										
SAT	0.79	0.49	0.981	0.148	0.426	0.3	0.326	0.06	0.38	**0.7**									
AW	0.819	0.48	0.983	0.052	0.223	0.374	0.247	0.131	0.123	0.407	**0.693**								
EF	0.804	0.509	0.984	0.13	0.353	0.162	0.405	0.328	0.293	0.243	0.092	**0.713**							
ATGI	0.938	0.628	0.987	0.566	0.505	0.208	0.408	0.02	0.643	0.259	0.02	0.192	**0.793**						
EA	0.952	0.713	0.99	0.294	0.296	0.107	0.244	0.191	0.358	0.138	0.155	0.247	0.508	**0.844**					
BS	0.772	0.631	0.99	0.282	0.334	0.185	0.194	0.025	0.502	0.261	0.053	0.068	0.356	0.202	**0.794**				
PU	0.824	0.54	0.991	0.378	0.599	0.301	0.423	0.097	0.73	0.377	0.152	0.248	0.561	0.351	0.709	**0.735**			
SN	0.898	0.642	0.992	0.24	0.312	0.146	0.18	0.136	0.408	0.13	0.155	0.207	0.451	0.8	0.212	0.327	**0.801**		
RBP	0.814	0.47	0.992	0.085	0.346	0.413	0.207	0.078	0.319	0.371	0.314	0.27	0.243	0.163	0.222	0.284	0.167	**0.685**	
PWOM	0.821	0.41	0.912	0.065	0.246	0.313	0.107	0.068	0.439	0.341	0.318	0.24	0.243	0.153	0.136	0.183	0.134	0.112	**0.567**

Note: *CR = Composite reliability, AVE = Average variance extracted, Diagonal values show square root of AVE. Off-diagonal values show correlations. In all the cases, the square roots of AVEs are greater than correlations, therefore it supports discriminant validity.*

SECTION IV

Test of study Hypotheses

To test the proposed hypotheses, the study applied Structural Equation Modelling (SEM) technique using maximum likelihood (ML) estimation. Specifically, the study conducted a covariance based SEM technique. This covariance based SEM is preferable when the researcher tries to test and confirm the proposed model under consideration. The SEM technique has applied to test the study hypotheses because of several reasons. First, the constructs proposed in this study are measured using multiple questions, and therefore the constructs are latent in nature. In this case, SEM technique is more preferable over other techniques, if the objective is to capture the inter-relationship between the proposed constructs under consideration. Secondly, in the hypotheses formulation section, the researcher proposed several relationships, which involved the interrelationship between several variables, in a simultaneous fashion. Finally, it also recommended that SEM is more useful in case of variables with multiple items, where the researcher likes to capture item-wise error rate. The SEM modelling involves different phases. In the first phase, the researcher made a diagrammatic representation of the relationship between the study variables (See Figure 5.1). In the second phase, the study estimated the goodness of fit coefficients of the conceptual model and examined the goodness of fit of the model with the observed data. In this goodness of fit indices, the researcher examined various fit indices. In case of fit indices there exists a confusion among researchers as to which fit indexes to report. Jaccard and Wan (1996) recommend the use of at least three fit tests, one from each of the first three categories like absolute fit, relative fit and parsimony measures as reported in Table 5.19.

Table 5.19

Fit Measures used in assessing goodness of fit of SEM Model

Category	Fit Indices
Absolute Fit Measure	CMIN, CMIN/df, RMR, SRMR, GFL, PGFI
Relative fit measures	NFI, RFI, IFI, TLI
Parsimony Measures	PRATIO, PNFI, PCFI
Chi-square distribution	NCP,FMIN, RMSEA
Theoretic Fit measures	AIC, BIC, BCC,ECVI
Fit measures on sample size	HOERLTER

Reference: Hair et al. (2010)

Following the suggestion given by Kline (2005), in this study the researcher followed the fit measures, such as χ^2, the ratio of chi-square to df, IFI, GFI, NFI, SRMR, RMSEA, TLI and CFI. In these fit measures, we expect an insignificant χ^2. However, in a study with high sample size one cannot expect insignificant χ^2. In case of other fit indices such as GFI, NFI, TLI and CFI, the fit indices above the suggested cut-off of 0.90 show a good model. In case of RMSEA and SRMR, if the fit measures are below the value of 0.08, it indicates a good model.

As shown in Table 5.20, the study found a satisfactory fit of the structural model [Chi-square: $\chi2 = 6960.50$ (df = 3631), p = .001; the ratio of Chi-square to degrees of freedom: $\chi2/df = 1.91$; Comparative Fit Index: CFI = .836; Incremental Fit Index: IFI = .838; Standardized Root Mean Square Residual: SRMR = .058; Root Mean Square Error of Approximation: RMSEA = .049]. In this assessment of important model fit indices as reported in Table 5.20, such as the ratio of Chi-Square to degrees of freedom (CMIN/df) or normed chi-square which minimizes the impact of sample size on the Model Chi Square (Wheaton, Muthen, Alwin, & Summers, 1977), were deemed an acceptable ratio at 1.91, because it was less than the suggested limit of 2.0 (Tabachnick & Fidell, 2007). Another important index of assessment is RMSEA, which tests how well the model fits

the population's covariance matrix (Byrne, 1998). The measure is considered "one of the most informative fit indices to consult due to its sensitivity to the number of estimated parameters in the model" (Diamantopoulos & Siguaw, 2000, p. 85). An estimated RMSEA well below .08 supports a good fit (Mac Callum, Browne, and Sugaware, 1996; Steiger, 2007), which was the case with this study results as well. Another, crucial index is SRMR, which confirms the "square root of the difference between the residuals of the sample covariance matrix and the hypothesized covariance model" (Hooper, Coghlan, & Mullen, 2008, p. 54). An SRMR value .08 or lower is deemed to be acceptable (Hu and Bentler, 1999). In support of this suggestion, the researcher found that in the current structural model the study found an SRMR of 0.058. All these fit indices indicated that the collected data fit the model well, and therefore the current model can be used to test the proposed hypotheses of the study.

Further, the study examined the path coefficients to test the proposed set of study hypotheses. While checking the path coefficients, it was found that that all the estimated path coefficients followed the researchers' expectation with regard to direction and magnitude. Table 5.20 given below provides the estimated path coefficients derived from the model. In this Table, the first and second columns show the relationship between the exogenous and endogenous constructs. The third column reported the unstandardized path coefficients. In the fourth column, the standardized path coefficients are provided. Next, to standardized path estimates, in the fifth column, standard errors are provided. In the final column, the Table reported the status of hypotheses testing results (i.e. accepted or rejected).

Table No.5.20
Goodness of fit-measures of the Structural Model

Fit indices	Estimated values
χ^2	6960.50(df = 3631, *p* = .001)
χ^2/df	1.91
CFI	0.836
IFI	0.838
GFI	0.7
TLI	0.827
RMR	0.055
SRMR	0.058
RMSEA	0.049

Note: The model fit indices reported here generated from the SEM model.

Table No.5.21

Test of Hypotheses

Endogenous variable	Exogenous Variables	Unstd.	Std	S.E.	Hypothesis
		Estimate	Estimate		Status
PRO →	**SAT**	0.134	0.059	0.05	H1 supported
PRI →	**SAT**	0.192	0.171	0.041	H2 Supported
COM →	**SAT**	0.23	0.276	0.062	H3 Supported
CON →	**SAT**	0.124	0.183	0.058	H4 Supported
SOA →	**SAT**	0.616	0.585	0.107	H5 Supported
EOU →	**SAT**	0.154	0.174	0.068	H6 Supported
SAT →	**CAI**	0.712	0.485	0.112	H7 Supported
AW →	**CAI**	0.114	0.123	0.048	H8 Supported
EF →	**CAI**	0.316	0.485	0.117	H9 Supported
ATGI →	**CAI**	0.132	0.121	0.018	H10 Supported
EA →	**CAI**	0.612	0.315	0.102	H11 Supported
BS →	**CAI**	0.133	0.164	0.068	H12 Supported
PU →	**CAI**	0.614	0.523	0.103	H13 Supported
SN →	**CAI**	0.512	0.315	0.112	H14 Supported
CAI →	**RPB**	0.233	0.254	0.073	H15 Supported
CAI →	**PWOM**	0.573	0.423	0.132	H16 Supported

In the first hypothesis, the study made a proposition that PRO has a positive impact on SAT. In support of this proposition, the unstandardized path estimates were significant ($\beta = 0.134$, $p < 0.01$). Thus, the study found support for Hypothesis 1.

In hypothesis 2, the study postulated that PRI has a positive impact on SAT. In support of this, the study received statistical support for the path coefficient ($\beta = 0.192$, $p < 0.01$).Thus, the study supported Hypothesis 2.

In hypothesis 3, the study proposed that COM has a positive impact on SAT. The examination of the path estimates supported a significant effect ($\beta = 0.230$, $p < 0.01$). Thus, the study supported hypothesis 3.

As postulated in hypothesis 4 that CON has a positive impact on SAT, the study results supported a significant path estimate ($\beta = 0.124$, $p < 0.01$). Thus, the study supported hypothesis 4.

Further, in hypothesis 5, the study postulated that SOA has a positive impact on SAT. In support of this, the path estimates shown a significant impact ($\beta = 0.616$, $p < 0.01$). Thus, the study supported hypothesis 5.

In hypothesis 6, the study made a postulation that EOU has a positive impact on SAT. Following the stated proposition, the study results supported significant path estimates. ($\beta = 0.154$, $p < 0.01$). Thus, the study supported hypothesis 6.

Further, in hypothesis 7, the study made a proposition that SAT has a positive impact on CAI. In support of this presumption, the data analysis results supported a significant path estimates ($\beta = 0.712$, $p < 0.01$). Thus, the study supported hypothesis 7.

In hypothesis 8, the study proposed that AW has a positive impact on CAI. In support of this proposition, the path estimates of this relationship supported a significant effect ($\beta = 0.114$, $p < 0.01$). Thus, the study supported hypothesis 8.

In hypothesis 9, it was proposed that EF has a positive impact on CAI. In this line, while analysing the estimates, the study results supported a statistically significant path

estimates (β = 0.316, p< 0.01). Thus, the study received support for hypothesis 9, and accepted the same.

In hypothesis 10, the study made a proposition that ATGI has a positive effect on CAI. In support of with this assumption, the analysis of the particular path estimates using SEM, the study found a significant path estimates (β = 0.132, p< 0.01). Thus, the study supported the hypothesis 10.

In hypothesis 11, the study postulated that EA has a positive impact on CAI. In support of the stated postulation, here in the analysis, the study found statistical evidence (β = 0.612, p< 0.01). Thus, the study supported the hypothesis 11.

In hypothesis 12, the study assumed that BS has a positive impact on CAI. In align with the stated presumption, the path estimates supported a significant effect (β = 0.133, p< 0.01). Thus, the study supported the proposition as mentioned in the hypothesis 12.

In hypothesis 13, the study made a postulation that PU has a positive impact on CAI. While checking the specific path estimate, it supported a significant effect (β = 0.614, p< 0.01). Thus, the study found support for the stated postulation that is hypothesis 13.

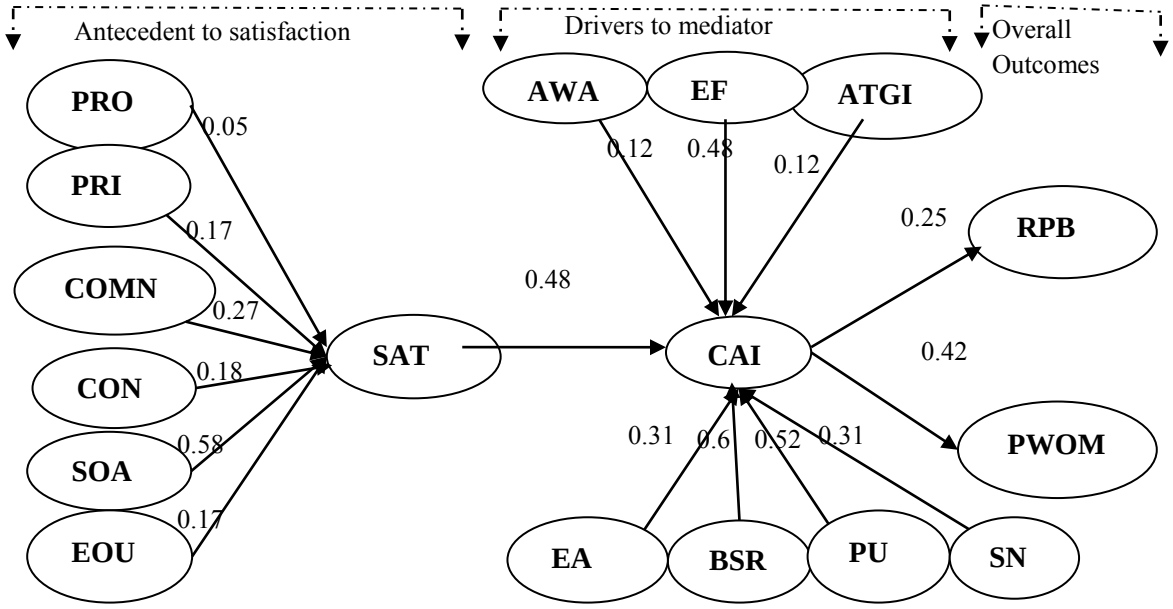
In hypothesis 14, the study postulated that SN has a positive impact on CAI. In support of the stated postulation, here in the analysis, study found statistical evidence (β = 0.51, p< 0.01). Thus, the study supported the hypothesis 11.

In hypothesis 15, the study assumed that CAI has a positive impact on RPB. In align with the stated presumption, the path estimates supported a significant effect (β = 0.23, p< 0.01). Thus, the study supported the proposition as mentioned in the hypothesis 12.

In hypothesis 16, the study made a postulation that CAI has a positive impact on PWOM. While checking the specific path estimate, it supported a significant effect (β = 0.57, p< 0.01). Thus, the study found support for the stated postulation that is hypothesis 13.

Figure: 5.2

Structural Equation Model of Antecedents and Consequences of RTPV Adoption



Note: All hypotheses supported Goodness of fit-measures of the Structural Model

[χ^2 =6960.50(df = 3631, p = .001), χ^2/df=1.91, CFI=0.836, IFI=0.838, GFI=0.7, TLI=0.827, RMR=0.055, SRMR=0.058,RMSEA=0.049]

5.20 Chapter Summary

In this chapter the researcher explained the detailed data analysis process conducted to test the proposed study hypotheses. As part of this testing, first, the study examined the demographic and psychographic characteristics of the study participants. Followed by this, in the second section, the study detailed the results of Exploratory Factor Analyses to examine the unidimensionality of the scale measures. Further, the study conducted measurement model testing through Confirmatory Factor Analysis to check the reliability and validity of the scale measures. After confirming the reliability and validity of the scale measures, the study tested the proposed set of hypotheses using Structural Equation Modelling Technique. In this testing, the study observed the entire proposed model is very robust and fit well with the data. Later, the test of hypotheses also supported the significance of all the proposed hypotheses.

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CHAPTER 6

BUYING BEHAVIOUR AND CHALLENGES TOWARDS RTPV MARKET- A CONSUMER AND DEALER PERSPECTIVE

Chapter 6

Buying Behaviour and Challenges towards RTPV Market- A Consumer and Dealer Perspective

6.1 Introduction

This chapter consists of some additional findings about the influence of pre and post RTPV adoption factors among different socio demographic groups and aims to identify the major challenges faced by the dealers in RTPV market in Kerala. One sample t test, Independent sample t test, one way ANOVA, and Multiple comparison test were used to analyse and interpret in order to summarise the findings and draw appropriate conclusion. This Chapter deals with the factors which drive the pre and post adoption behaviour of actual RTPV adoption.

An overview of the Kerala solar energy scenario, especially the achievements of 'ANERT' in the SPV penetration in Kerala, has been explained in the previous chapter. As the SNA of the central ministry, the agency played an implementing role in the deployment of non conventional energy. As it is recognized that government incentives have played a major role in upscaling RE technologies all over the world, here, the researcher took 10000 solar programme beneficiaries for the study as it is has paved the way for commercialization of SPV in Kerala. Popularization of this micro generation energy technology is necessary in order to reduce the energy purchase by the state during the peak hours. In order to achieve the target specified in the solar policy of the state, the product needs to reach more segments of the society. As this product installation calls for high investment and a longer payback to break even, the penetration of this product had not reached all consumer segments.

Section 1

Perception of Domestic Users in Kerala on RTPV

6.2 Awareness regarding Types of Solar Energy Products in Kerala

There is a variety of domestic as well as non domestic applications available as solar photovoltaic and thermal technologies. Even though most commonly used products in solar energy technology are Solar Water Heater (SWH), and street lights, the SPV is in a gradually developing stage. In addition, there are other solar energy products which are available in the market like Solar Home Light (SHL), mobile charger, cooker, dryer, pump and bag. Lack of awareness about the availability of various solar energy products is the primary impediment for the successful diffusion of these products, (Sahu, 2012) which can play a major role in taking purchase decision of the product. Firstly, in this section respondents are asked to rate the overall awareness regarding various types of solar energy products. Therefore our objective is to find the level of awareness of solar energy products. For this the respondents are asked 11 questions on five point Likert scale. The responses are scored as 1 for 'No opinion', 2 for 'Not at all aware', 3 for 'Not much aware',4 for 'Aware'5 for 'Highly Aware''. Awareness of solar energy products among RTPV consumers in Kerala is calculated and a one sample t test is used to know whether the sample information exists in the population. Hence, the researcher formed the following hypothesis

H17.A $_{(1) \text{ to } (11)}$: Awareness of various solar products among RTPV users is significant in Kerala

Table No. 6.1

One sample t test showing the level of Awareness of Consumers regarding various Solar Energy Products (test value 3)

Sl. No	Solar Energy Products	Mean Score	Rank	t	P	Decision	Discussion
1	SPV	4.54	1	47.770	.000**	Significant	Reject $H_{0(1)}$ – High
2	SWH	4.25	2	24.857	.000**	Significant	Reject $H_{0(2)}$ – High
3	Lantern	3.80	4	13.171	.000**	Significant	Reject $H_{0(3)}$ – High
4	Solar home pack	2.80	8	3.259	.001**	Significant	Reject $H_{0(4)}$ – Low
5	Solar cooker	3.14	5	2.250	.025*	Significant	Reject $H_{0(5)}$ - High
6	Solar pump	3.05	6	.806	.421	Insignificant	$H_{0(6)}$ not rejected
7	Solar Mobile charger	3.03	7	.506	.576	Insignificant	$H_{0(7)}$ not rejected
8	Solar bag	2.46	11	9.981	.000**	Significant	Reject $H_{0(8)}$ - Low
9	Solar street light	3.87	3	15.877	.000**	Significant	Reject $H_{0(9)}$ - High
10	Solar cap	2.52	10	8.641	.000**	Significant	Reject $H_{0(10)}$ - Low
11	Solar dryer	2.75	9	4.034	.000**	Significant	Reject $H_{0(11)}$ - Low
* sig. @ 5 per cent ** sig. @ 1 per cent						Source: primary data N = 315	

Table 6.1 provides the results of testing of hypothesis $H_0$17.A $_{(1)}$ to $_{(11)}$ which is related to the information regarding awareness of consumers about solar energy products in Kerala. One sample t test was performed to determine if there is a statistically significant difference between the awareness score of solar energy products with average value. Testing of hypothesis @ 5 per cent, and 1 per cent level of significance shows that Awareness regarding SPV ($t = 47.770$, $p < 0.01$,M=4.54),

SWH (t = 24.851, p < 0.01,M=4.25), solar lantern (t = 13.171, p < 0.05, M=3.80) solar street light (t = 15.877, p < 0.01, M=3.87), and solar cooker (t = 2.250, p < 0.05, M==3.14) indicates a statistically significant difference from average and also showing high level of awareness. Therefore $H_0$17.A $_{(1)\ ,\ (2),\ (3),\ \text{and}\ (9)}$ rejected at the 1 per cent level and $H_0$17.$_{(5)}$ rejected at 5 per cent level.

Considering the awareness regarding solar home pack (t=3.259, p<0.01, M=2.80) solar bag (t=9.981, p<0.01, M=2.46), solar cap (t=8.641, p<0.01, M=2.52) and solar dryer (t=4.034, p<0.01, M=2.75) it is found to have statistically significant difference from average score, hence rejected $H_0$17.A$_{(4)\ ,\ (8),\ \ (10),\ (11)}$ at 1 per cent level of significance which shows very low awareness .

Likewise, solar pump (t=.806,p> 0.05) , and solar mobile charger (t=.506, p>0.05) are not statistically significant because p>0.05. Hence $H_0$17.A$_{(6)\ \text{and}\ ,\ (7),}$ were not rejected and show an average awareness with mean score (3.05) and (3.03) respectively.

So it can be inferred that out of eleven solar energy products, nine products proved to be significantly higher than central value while two of them proved to be insignificant. It is quite obvious that the respondents are SPV consumers, and they may be more familiar with that product. SWH, lantern, street lights and cooker are familiar among respondents. However in the case of other solar products they have only average or low awareness.

6.3 Awareness Level of SPV/RTPV System Features

SPV system is an innovative green energy product which has seen a significant growth all over the world. Higher level of basic knowledge of Renewable Energy (RE) displayed in the past is found to increase the likelihood of adoption of new technology (Arkesteijn & Oerlemans, 2005). Further (Keriri, 2013) revealed that increase in the knowledge and awareness would lead to increase in adoption. Government is striving hard to achieve the ambitious targets by adequate policy interventions like net metering, feed in tariffs (FIT) etc. FIT is a new concept in India which is successfully implemented all over the world, especially in Australia, Canada, Italy, Spain, Denmark and the US. RTPV is a micro generation technology

which can be used for decentralized applications. Consumers show interest to adopt this technology, at the same time, they may have lack of knowledge about the basic features of the system. The SPV system can be classified into two types: 1) solar rooftop system with storage/ battery capacity (off-grid) and 2) grid connected solar rooftop system (on-grid). Sufficient knowledge about the functioning of the adopted system is necessary to make a tradeoff between the benefits and drawbacks of each type of system and to achieve satisfaction. Thirteen states have notified policies for the promotion of rooftop solar and net metering facility is available for on-grid consumers in Kerala. Net metering is a billing mechanism which allows the consumers to export the generated electricity to the grid if system owners produce more than what they want during day time and can import for consumption at night when they needed. Feed in Tariff on the other hand, is also a measure related to grid interactive system aimed at accelerating investment by offering long term contracts by RE generators on supply to the grid. Both these policies are meant for supporting RE deployment. The study took the awareness into various dimensions, like basic product features, functioning, environmental aspects, cost related matters and latest updating in supporting government policies so as to possess necessary knowledge by the consumers in these specified matters. In brief, it can be classified into policy related matters, sustainability and economic, technical requirements and financial requirement. This will make the users more confident and can inculcate the level of acceptance about this new technological product among users. Further, it will boost the confidence of existing users to recommend to other prospective consumers. In addition, they can adopt the right type of system if they want capacity additions in future. An analysis has been conducted to understand the level of awareness of the users about the system by rating their awareness on 20 statements regarding SPV in various aspects on a five point scale. Furthermore, the government already ordered a reduction of Rs.1 for units generated from SPV for encouraging its use. The following table would give results of one sample t test for measuring consumer's awareness on SPV. The study formed the following null hypothesis for the study.

H17.B $_{(1) \text{ to } (20)}$: Awareness level of users regarding RTPV system is significant in Kerala

Table No. 6.2

One sample t test showing the awareness level of RTPV system

Sl No	Awareness	Mean Score	Rank	t	P	Decision	Discussion
1	Green product	4.57	2	43.602	.000**	Significant	Reject $H_{0(1)}$- High
2	Electricity Reduction	4.64	1	53.680	.000**	Significant	Reject $H_{0(2)}$- High
3	Cost saving	4.50	3	36.950	.000**	Significant	Reject $H_{0(3)}$- High
4	Sustainable	4.33	6	26.476	.000**	Significant	Reject $H_{0(4)}$- High
5	Aware about on-grid	4.04	9	17.232	.000**	Significant	Reject $H_{0(5)}$- High
6	Aware about changing battery after 5 years	4.36	4	31.013	.000**	Significant	Reject $H_{0(6)}$- High
7	Approximate cost of battery replacement	4.34	5	7.968	.000**	Significant	Reject $H_{0(7)}$- High
8	No further charging if battery reached 100 per cent	4.19	8	6.990	.000**	Significant	Reject $H_{0(8)}$- High
9	On grid system won't work during power cut	3.60	10	5.208	.000**	Significant	Reject $H_{0(9)}$- High
10	2 kw on grid scheme	3.16	13	2.547	.011**	Significant	Reject $H_{0(10)}$- High
11	Inverter change in case of off-grid to on-grid transformation	3.49	11	2.792	.006**	Significant	Reject $H_{0(11)}$- High
12	Capital subsidies	4.25	7	28.235	.000**	Significant	Reject $H_{0(12)}$- High
13	CERC order about reduction in bill amount	2.81	18	2.546	.011**	Significant	Reject $H_{0(13)}$- Low

14	Requirements for getting CRC reduction	2.74	19	3.566	.000**	Significant	Reject $H_{0(14)}$- Low
15	Net metering	2.94	16	.778	.437	Insignificant	Not Rejected $H_{0(15)}$ – Low
16	FIT	2.98	15	.183	.855	Insignificant	Not Rejected $H_{0(16)}$ – Low
17	Solar energy policy	3.35	12	5.443	.000**	Significant	Reject $H_{0(17)}$- High
18	Procedures for off grid to on grid transformation	2.88	17	1.806	.072	Insignificant	Not Rejected $H_{0(18)}$ –Low
19	Need of small battery for uninterrupted working of on grid system during power cut	3.05	14	.843	.400	Insignificant	Not Rejected $H_{0(19)}$ – Average
20	Hybrid solar system	2.72	20	4.377	.000**	Significant	Reject $H_{0(20)}$- Low
* sig. @ 5 per cent ** sig. @ 1 per cent						Source: primary data N = 315	

One sample t test was done to evaluate the awareness level regarding SPV system among Kerala consumers. There is significantly high difference from the average value found at $p<0.01$ in green aspect of SPV product ($t=43.602$, $p<0.01$,$M=4.57$), electricity reduction ($t=53.680$, $p<0.01$,$M=4.64$), cost saving ($t=36.950$, $p<0.01$, $M=4.50$), sustainable ($t=26.476$, $p<0.01$,$M=4.33$), awareness about on-grid ($t=17.232$, $p<0.01$,$M=4.04$), aware about changing battery ($t=31.013$, $p<0.01$,$M=4.36$), cost of battery replacement after five years ($t=7.968$, $p<0.01$, $M=4.34$), aware about further charging is not possible if 100 battery charging is done ($t=6.990$, $p<0.01$, $M=4.19$), on-grid won't work during power cut ($t=5.208$, $p<0.01$, 3.60), aware about 2 kw on-grid scheme ($t=2.547$, $p<0.01$, $M=3.16$), aware about inverter change in case of off-grid to on-grid transformation ($t=2.792$, $p<0.01$, $M=3.49$), capital subsidies ($t=28.235$, $p<0.01$, $M=4.25$), aware about government

policy relating to mandatory implementation of 1 kw rooftop solar for houses with more than 2500 sq.ft. ($t=5.443, p<0.01, M=3.35$).

Awareness about CERC order relating to reduction of monthly electricity bill ($t=2.546$, $p<0.01$, $M=2.81$), requirements for getting CERC reduction ($t=3.566$, p, 0.01, $M=2.74$), awareness about solar hybrid system ($t=4.377$, $p<0.01$, $M=2.72$) also shows significant difference from average value and the mean score analysis reveals they have low level of awareness.

However there are no significant differences found in net metering ($t=.778$, $p>0.05$, $M=2.94$), FIT ($t=.183$, $p> 0.05$, $M=2.98$), procedures for off-grid to on-grid transformation ($t=1.806$, $p>0.05, M=2.88$), and need of small battery for uninterrupted working of on-grid system during power cut ($t=.843$, $p>0.05, M=3.05$).

So it is imperative to note that the consumers have a perceived knowledge of green aspects, electricity reduction, and basic difference between off-grid and on-grid. However they are not aware of the procedures and formalities involved in on-grid transformation and its functioning. It is imperative to note that users are not getting the CERC reduction and they are not very well aware of supporting policies also.

6.4 Factor Analysis- Awareness regarding RTPV system

Effective utilization of SPV depends on the awareness about basic technical knowledge required to system performance, its nature, incentives and scheme and future possible expenses in relation to maintenance of the system. (Claudy, 2011) stated that commercialization of solar panels is relatively a new phenomenon, even though they have existed for decades and pointed out that lack of technical literacy still existed in the consumer market. Therefore an attempt is made here to check the various dimensions of awareness of this technological innovative energy product. To analyse the factors contributing to awareness regarding SPV, Exploratory Factor Analysis (EFA) was conducted with the sample respondents indicating their awareness of SPV on a five point scale within identified 20 variables. Principal Component Analysis (PCA) was employed for extracting factors or dimensions and factors having an Eigen value greater than one are considered significant.

Table No. 6.3

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.865
Bartlett's Test of Sphericity Approx. Chi-Square	2515.385
Sig.	.000

From the table, it is observed that Kaiser-Meyer-Olkin Measure of Sampling adequacy value is found to be 0.865 which measures whether the distribution of values is adequate for conducting factor analysis. A high value of this indicates the appropriateness of the factor analysis for the data collected. In this value KMO value is as high as 0.865 which is very good. Value between 0.8 and 0.9 is considered 'meritorious' (Brah & Rao, 2002). Bartlett's test of sphericity examines the item to item correlation by using chi square and found to be significant at 190 degrees of freedom (Chi =2515,$p<0.05$), which shows the significant correlation among variables. This score tests the hypothesis whether the population correlation matrix is an identity matrix. A value less than 0.05 indicate that the data in hand does not produce an identity matrix. This means that there exists a significant relationship among the variables taken for the factor analysis.

Table No. 6.4

Total Variance Explained

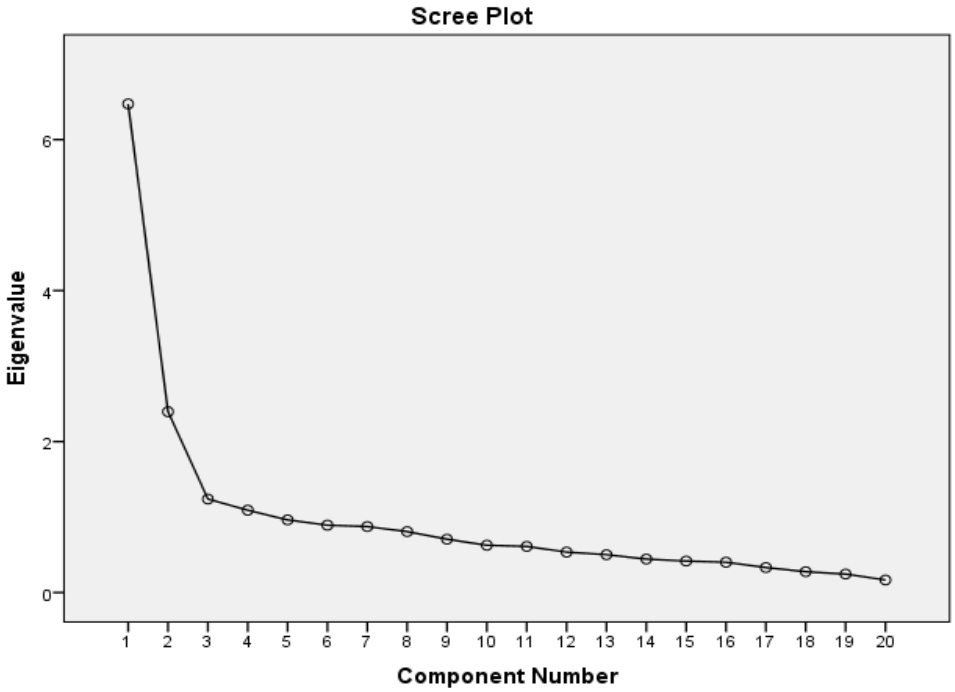
Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	Per cent of Variance	Cumulative Per cent	Total	Per cent of Variance	Cumulative Per cent	Total	Per cent of Variance	Cumulative Per cent
1	6.472	32.360	32.360	6.472	32.360	32.360	5.039	25.193	25.193
2	2.396	11.978	44.338	2.396	11.978	44.338	2.910	14.552	39.746
3	1.239	6.194	50.532	1.239	6.194	50.532	1.656	8.279	48.025
4	1.091	5.455	55.987	1.091	5.455	55.987	1.592	7.962	55.987

Extraction Method: Principal Component Analysis.

The table 6.4 labeled Total Variance Explained lists the Eigen values associated with each factor before extraction, after extraction, and after rotation. The Eigen values associated with each factor represent the variance explained by that particular linear component and the table also displays the Eigen values in terms of

percentages of variance explained (Factor 1 explains 32.360 per cent of total variance). It should be clear that the first few factors explain relatively large amounts of variance (especially factor 1), whereas subsequent factors explain only a small amount of variance. The table extracts four factors where 55.987 per cent of the cumulative variance is explained. The sets of 20 variables are split into four components, or factors which have the Eigen value greater than 1. These four factors altogether explained 55.987 per cent of the variable in the final part of the table, the Eigen values of the factors after rotation are displayed. Before rotation, factor 1 accounted for considerably more variance than the remaining five (32.360 per cent compared to 11.978 per cent, 6.194 per cent, and 5.455 per cent). However, after extraction, it accounts for only 25.193 per cent of the variance (compared to 14.552 per cent, 8.279 per cent and 7.962 per cent) respectively.

Figure No. 6.1



PCA analysis has resulted in four factors considering 20 variables. This table explains the percentage of variances and Eigen values of the four components which explained the 55.987 percentage of total variance. Thus these four factors are identified as the indicators which explain the awareness regarding RTPV. These four factors that are extracted from EFA each having Eigen value exceeding one.

Table No. 6.5
Factors for Awareness Regarding SPV

Sl.No	Names of Factors	Statements	Loadings
Factor 1	Policy Related	I am aware about the installation of a meter from KSEB is necessary for getting CERC reduction	.821
		I am aware of CERC order of exemption of Rs.1 for one unit for 1kw owners	.790
		1 am aware of net metering facility for on-grid system	.786
		I am aware about Feed in Tariff for solar energy	.757
		I am aware of the procedures for changing off-grid system to on-grid	.738
		I am aware of solar energy policy of Government and mandatory installation of solar in houses having more than 2500sq.ft	.655
		I am aware of small battery backup needed for uninterrupted working of my on-grid system during the time of power cut	.634
		I am aware of hybrid solar system	.573
		I am aware about existing on-grid scheme for 2 KW	.563
		I am aware about on-grid type power plant	
		I am aware of changing inverter if I want to change the system from off-grid to on-grid	
Factor 2	Sustainability and Economical	I am aware that it is useful in electricity reduction	.867
		I am aware that it is cost saving	.790
		I am aware that it is sustainable energy saving product	.716
		I am aware that solar energy product is a green product	.663
		I am aware of capital subsidies for solar system	
Factor 3	Technical Requirements	I am aware of the facts that no further change will be possible if battery charge reaches 100% and needs to switchover	.695
		I am aware about on-grid system will not work during power cut	.560
Factor 4	Future Financial Requirement	I am aware about the approximate cost incurred for battery replacement	.741
		I am aware about changing battery after 5 year of installation	.668

Table 6.5 illustrates the result of PCA of awareness construct. The factors of awareness which are grouped into four factors are explained briefly below. One group extracted more than 25.193 per cent of variance consisting of nine items. These variable together constitutes a common factor, which is related to the 'policy and government incentives' related to the system. Hence it was named as policy related matters. The second factor is related to 'sustainability and economical'. The third most important factor is technical requirements and finally, the last important factor is 'Future Financial Requirements for System Maintenance**'.**

6.5 Effectiveness of Media for getting Awareness about Solar Energy Product

Radical change in consumer preferences for green products from gray products is witnessed all over the world. The role of media in disseminating information to public is becoming vital in marketing function which ensures the successful launching and commercialization of the product. The critical role of media in identifying environment- friendly energy products and for providing an informative base is inevitable. Consequently, it has been recognized as an effective tool for creating immediate awareness, successfully communicating promotional programmes, and positioning of a new product in the mindset of the public to obtain the desired result from the target audience. There are personal and non personal-communication channels available, i.e. friends and relatives, dealers, print media (news paper, magazine, direct mail) broadcast media (radio, TV), online media (website, email, online social and sharing networks). In addition, there are awareness campaigns by ANERT for promoting the adoption and use of solar energy was also conducted. The accessibility and preference of media may be different for consumer segments, niches and even for individuals. So a marketer must take due care in selecting media effectively. Hence the study assessed the respondents perception about the influence of media with the help of one sample t test.

H 17.C $_{(1)}$ to $_{(7)}$: RTPV users perception towards the effectiveness of different media for getting awareness about solar energy products is significant in Kerala.

Table No.6.6

One Sample t test showing Effectiveness of Media in Disseminating Awareness regarding Solar Energy Product

Sl. No	Media	Mean	Rank	t	p	Decision	Discussion
1	Print Media	4.23	2	24.610	.000**	Significant	Reject $H_03_{(1)}$ – High
2	TV advertisement	4.25	1	25.246	.000**	Significant	Reject $H_03_{(2)}$ – High
3	Friends and Relatives	3.78	5	13.606	.000**	Significant	Reject $H_03_{(3)}$ – High
4	Exhibitions	3.82	4	14.325	.000**	Significant	Reject $H_03_{(4)}$ – High
5	Solar dealer	3.33	7	5.090	.000**	Significant	Reject $H_03_{(5)}$ – High
6	ANERT Awareness Campaign	3.85	3	13.645	.000**	Significant	Reject $H_03_{(6)}$ – High
7	Internet	3.70	6	10.762	.000**	Significant	Reject $H_03_{(7)}$ – High
* sig. @ 5 per cent ** sig. @ 1 per cent						Source: primary data N = 315	

One sample t test was performed to know the opinion of consumers regarding the effectiveness of different media for getting awareness about solar energy products. Test results indicate that there is statistically significant difference exists at $p<0.01$ level for print media ($t=24.610$, $p<0.01$, $M=4.23$), TV advertisement ($t=25.246$, $p<0.01$, $M=4.25$), friends and relatives($t=13.606$, $p<0.01$, $M=3.78$), exhibitions ($t=14.325$, $p<0.01$,$M=3.82$), solar dealers ($t=5.090$, $p<0.01$, $M=3.33$), ANERT awareness campaign ($t=13.645$, $p<0.01$, $M=3.85$), Internet ($t=10.762$, $p<0.01$, $M=3.70$). Therefore $H_017.C_{(1)}$ to $H_017.C_{(7)}$ were rejected at 1 per cent level of significance. Hence, perception regarding effectiveness of different media shows significant difference from average value. By analyzing mean score it is inferred that

the perceived effectiveness of all medias are above average .Hence, it is advised that a combination strategy of both personal and impersonal channels must be used by the marketers while communicating information.

It is implied from the table that a majority share of the respondents preferred to putting in advertisements through mainstream media like TV. It can be further noted that awareness through dealers stood last. So dealers must adopt push strategies in order to attract more potential consumers towards this product.

6.6 Choice of Suppliers/Influencing factors for selecting company

Even though the '10000 solar rooftop programme' was jointly sponsored by Central and State Governments, only Central Government accredited channel partners included in the program. Furthermore, ANERT has selected channel partners based on certain specifications. The beneficiaries are free to select one company from that list based on their preferences. Here, an attempt is made to investigate the influencing factors of consumers for selecting company for SPV adoption/implementation. It is possible to draw some influences related to influencing factors for selecting the company by sample respondents. The following table depicts the determinants of sample respondents with regard to influencing factors for selecting company. The researcher identified 11 variables to measure the significant factors influencing the selection of company and one sample t test was conducted to know the impact of each determinant. For this purpose, the study tests the hypothesis that follows:

H17.D $_{(1)}$ to $_{11)}$: Various factors determining the choice of suppliers for RTPV adoption by domestic users in Kerala are significant.

Table No.6.7

Choice of Suppliers

Sl No	Factors	Mean	Rank	T	p	Decision	Discussion
1	High quality of the System	4.05	3	16.372	.000**	Significant	Reject $H_{0(1)}$-High
2	Credibility and goodwill of the Company	4.16	1	19.578	.000**	Significant	Reject $H_{0(2)}$-High
3	Brand Image	4.11	2	7.809	.000**	Significant	Reject $H_{0(3)}$-High
4	Reasonable price	3.91	4	15.668	.000**	Significant	Reject $H_{0(4)}$-High
5	Opinion from friends and relatives	3.37	7	5.084	.000**	Significant	Reject $H_{0(5)}$-High
6	Advertisements	2.97	10	.334	.738	Insignificant	$H_{0(6)}$ not Rejected
7	Offering innovative features	3.04	9	.574	.566	Insignificant	$H_{0(7)}$ not Rejected
8	Years of experience	3.61	6	3.512	.001**	Significant	Reject $H_{0(8)}$-High
9	Easy accessibility	3.80	5	12.454	.000**	Significant	Reject $H_{0(9)}$-High
10	Good rapport with distributor	3.33	8	4.405	.000**	Significant	Reject $H_{0(10)}$-High
11	Offers and discounts	2.70	11	4.189	.000**	Significant	Reject $H_{0(11)}$-Low

* sig. @ 5 per cent
** sig. @ 1 per cent
Source: primary data
N = 315

Source: Survey data

One sample t test was carried out to test the above mentioned hypothesis reveals that statistically significant deviation from the average value is seen against the different determinants for selecting company by SPV consumers, except two variables. Hence $H_0 17.D_{(1),(2),(3),(4),(5),(8),(9),(10),(11)}$ are rejected at 1 per cent level of significance ($p<0.01$) while $H_0 17.D_{(6),(7)}$ are not rejected . Test results reveal that there is statistically high significant difference existing at $p<0.01$ level, viz. credibility and goodwill of the company ($t=19.578, p<0.01, M=4.16$) found to be the most important determinant for selecting company by SPV consumers following brand image ($t=7.809$, $p<0.01$, $\mu=4.11$), high quality of the system ($t=16.372$,

p<0.01, μ=4.05),reasonable price (t=15.668, p<0.01, μ=3.91), easy accessibility (t=12.454, p<0.01, μ=3.80), years of experience (t=3.512, p<0.01, μ=3.61), opinion from friends and relatives (t=5.084, p<0.01, μ=3.37) and good rapport with the distributor (t=4.405, p<0.01, μ=3.33).

However, mean value of 'offers and discounts' (t= 4.189, p<0.01, μ =2.70) indicates that it has a low impact on the selection of company. At the same time, 'advertisements' and ' offering of innovative products' were not rejected and show it has an average impact on the selection of company. It is obvious that consumers go for credibility of the suppliers when it is an innovative product. Further, the solar scam that happened in Kerala will give a further impetus to focus on credibility, brand image and high quality

6.7 Economic Factors

As RTPV is a high investment product, people may indulge in rational decision making before adopting the product. Regarding payback of the RTPV, it will take normally/comparatively longer time to break even depending on the electricity usage. In certain states of India, RTPV is reaching grid parity especially in the case of non domestic customers. Economic barriers are recognized as the primary impediment for RTPV penetration. Most of the humans are viewed as 'homo economicus'. "The economic challenge for RTPV adoption is that it is like paying for 15 years of electricity bills at once. Generally, narrow economic calculations like Return on Investment (ROI) and Pay Back (PB) are used to assess the relative importance of economic considerations for residential solar technology adoption (Schelly, 2014).

So in order to measure the significance of economic factors on SPVPP adoption, one sample t test was adopted. Here respondents are asked to rate the factors of economic considerations on a likert five point scale in order to know the priority given by consumers while adopting the system. Further, descriptive analysis using mean score also helps to identify the level of each economic factor considered by respondents while resorting adoption. In this research, ROI, maintenance cost, operational cost, comparison with fossil fuels with regard to external costs, safety from rising trend of energy costs, reduction in energy bill, added value to property,

affordability without subsidies, willingness of adoption without subsidy are taken as proxies to measure economic factors. For testing, the study formed a hypothesis that

H17.E $_{(1)}$ to $_{(10)}$: Various items regarding economic factors while adopting RTPV perceived by the consumers in Kerala are significant.

Table No.6.8

One Sample t test Regarding Economic Factors

Sl. No	Economic Factors	Mean	Rank	t	P	Decision	Discussion
1	I have taken the decision of installing SPV by considering ROI	3.13	8	1.890	.060	Insignificant	Not Rejected $H_{0(1)}$ – High
2	Less operational cost	3.89	3	15.439	.000	Significant	Reject $H_{0(2)}$ - High
3	Require minimum Maintenance	4.01	2	19.445	.000	Significant	Reject $H_{0(3)}$ - High
4	Solar energy would be more competitive if external cost of fossil fuels were taken into account	3.88	4	15.434	.000	Significant	Reject $H_{0(4)}$ - High
5	I think I am safe from predictable energy cost	3.58	6	9.185	.000	Significant	Reject $H_{0(5)}$ - High
6	My solar system will reduce my electricity bill	4.20	1	23.278	.000	Significant	Reject $H_{0(6)}$ - High

7	Adds value to my property	3.39	7	6.262	.000	Significant	Reject $H_{0(7)}$ - High
8	I think solar system is an affordable technology without subsidy	2.85	10	-2.136	.033	Significant	Reject $H_{0(8)}$ - Low
9	I would have been adopted solar even if there had been no subsidy	3.07	9	1.049	.295	Insignificant	Not Reject $H_{0(9)}$ -
10	Adopted solar because of government subsidy	3.87	5	13.800	.000	Significant	Reject $H_{0(10)}$ - High
* sig. @ 5 per cent ** sig. @ 1 per cent							Source: primarydata N = 315

An analysis using one sample t test is presented in the table 6.8. Testing of the above hypothesis at 5 per cent level shows that all the factors regarding Economic factors/items are statistically significant, except two items $H_0 17.E_{(1)}$ and $_{(9)}$ which is 'adoption of solar if there is no subsidy' ($t=2.136$, $p<0.05$, $\mu=2.85$) and 'taken the decision of installing SPV by considering ROI' ($t=1.890$, $p<0.05$, $\mu=3.07$). Hence the $H_0 17.E_{(2),(3),(4),(5),(6),(7),(8)}$ is rejected as p value is less than 0.01 for with regard to all other economic factors.

It can be evaluated from the table that the first important economic factor while adopting SPV, considered by consumers is 'the reduction in the electricity bill' ($t=$, $p<0.01$, $\mu=4.20$). Second important economic factor is 'minimum maintenance' ($t=19.445$, $p<0.05$, $\mu=4.01$) and third is 'less operational cost' ($t=15.439$, $p<0.01$,$\mu=3.89$) following 'competitiveness of solar energy when compared with external costs of fossil fuels' ($t=15.434$, $p<0.01$, $\mu=3.88$) standing as fourth indicates that

they have knowledge about the external cost involved with fossil fuel energy. However they are giving more priority to cost and electricity bill reduction. This finding is similar to (Schelly, 2014). **(**Herring, 2007) states that fiscally conservative consumers may view solar technology adoption as a means for lowering monthly electricity bill. They noted that energy saving, and reduction of fuel consumption are the major drivers. Further, this finding is consistant with that of Zhai &Williams, (2012) that public has tended to emphasize the role of cost reduction in promoting the adoption of residential PV. 'Adopted solar because of government subsidy' ($t=13.800$, $p<0.01$,$\mu=3.87$) standing as fifth shows the relevance of subsidy. This is also similar with the findings of (Schelly, 2014). (Herring, 2007) that incentives offered by government to cover upfront cost is a more important motivator than calculation of payback. In that study it is noted that payback is not a universally motivating economic factor. Sixth important factor is 'safe from rising trend of future energy costs' ($t=9.185$, $p<0.01$, $\mu=3.58$). 'SPV installation is an Added value to property' ($t=6.262$, $p<0.01$,$\mu=3.39$) stands in 7th position because it may be a new concept to Kerala consumers.

More importantly, 'Solar adoption by considering Return on Investment (ROI)' stands 8th indicates that consumers in Kerala have not gone for an indepth calculation by using financial metrics. So it is observed that ROI and PB like typical measures to measure the economic rationality of a large investment was not an important consideration for SPV adoption. This finding matches with that of (Schelly, 2014). The researcher mentioned in his study that no one asked about the payback period of televisions and cars but for installation of SPV, consumers look for cost – benefit.They also suggested that it is an option to invest if there is disposable income. And many things people buy may not pay back all the time. However this findings contradict with the arguments of (Rai & Andrews, 2008) that simple metrics like payback period are used by majority of adopters while evaluating the financial benefits . Further (Lu & Chen) found a moderating effect for financial assessment for successful adoption of Innovative Renewable Micro Generation Technologies (IRMGT). So rational economic calculations (decision making based on cost - benefit analysis) are not done by the customer. However, he often relies on heuristics or rules of thumb to guide their buying behavior (Bakker et al., 2014). And this

heuristics behaviour leads to more focus on purchase price and not on the operating expenses. In fact, earlier findings of (Herring, 2007) argued that anticipated payback was recognized as a major barrier. "SPV adoption without subsidy"($t=2.136, p<0.05, \mu=2.85$) stands in the 9th position ."Solar is affordable without subsidy stood in the 10th position indicating the importance of subsidy in SPV penetration. This is similar with the findings of (Schelly, 2014), (Chavan & Welling, 2013) that financial incentives positively correlated market acceptance of innovative technological product. Further it resembles the earlier research findings (Samad et al., 2013) that the demand for solar system will continue to grow even without subsidy if the price becomes affordable.

Therefore, it is clear from the testing of the above hypothesis at 5 per cent level that the effectiveness of economic variable while adopting SPV is above average. Hence the H_0 17.E is rejected as p value is less than 0.05 with regard to all economic factors except two items. People have to understand its long term benefits and environmental sustainability features. When compared with fossil fuels, the negative externalities of these sources are crucial while doing life cycle assessment. People need to understand the carbon reduction capacity of this product when comparing with fossil fuel sources. They need to give more importance to its sustainability features rather than its economic aspects. People should understand social pay back instead of individual payback. Therefore, they will give more emphasis to social benefits in the adoption of RTPV system. Moreover SPV will become cost beneficial on long term basis as there is a rising trend in electricity tariff from fossil fuels especially for consumers those who have high electricity consumption. Furthermore, SPV may benefit consumers who have higher electricity consumption. Social payback consideration is more desirable than calculating individual payback.

6.8 Attitude towards Government Initiatives (ATGI)

Ultimately, the marketing of RTPV comes under social marketing because it is intended for a social change through inculcating a behavioural change among consumers for accepting green energy. As State Nodal Agency of central ministry, ANERT have certain roles in implementing RE programmes, spreading awareness in

the community and inculcating a favorable attitude towards RE. So, the government is interfering in this market by introducing mandatory policies for compulsory implementation of solar panels in certain segments, incentive schemes in order to accelerate this socially useful implementation. So, in this section, the researcher tries to measure/evaluate the effectiveness/relevance of this social action efforts, particularly in SPV and its relative importance in performing a targeted behaviour. Hence this section consumers are asked to rate the existing programmes related to solar PV conducted by ANERT and about the effectiveness of awareness programme on a five point scale. The consumer's attitude towards the government initiatives is likely to have an effect on the adoption. Efforts of the Government are aimed at translating the motivation of the persons into action.

So in order to measure the significance of ATGI on SPV adoption, one sample t test was adopted. Here respondents are asked to rate the factors of 'ATGI' on a likert five point scale in order to know the priority given by consumers for each item in ATGI dimension while adopting the system. Further, descriptive analysis using mean score also helps to identify the level of ATGI considered by respondents while adoption. So in order to test the effectiveness of consumers towards government efforts on SPV adoption, the researcher formed a hypothesis that

H17.$F_{(1)}$ to $_{(6)}$: The effectiveness of various items/factors contributing Attitude towards Government Initiatives (ATGI) for SPV penetration in Kerala is significant.

Table No. 6.9

One Sample t test Regarding ATGI

Sl. No	ATGI	Mean	Rank	t	p	Decision	Discussion
1	Solar system will become mandatory in future	4.08	1	19.079	.000	Significant	Reject $H_{0(1)}$ - High
2	Government has made mandatory installation of solar in various consumer categories	2.63	6	-5.051	.000	Significant	Reject $H_{0(2)}$ -Low
3	I0000 rooftop programme of ANERT was effective	4.08	1	7.645	.000	Significant	Reject $H_{0(3)}$ High
4	Joint effort of KSEB and other government agencies with ANERT	3.98	2	17.821	.000	Significant	Reject $H_{0(4)}$ - High
5	Strict Government rules and regulations across the world	3.81	4	13.609	.000	Significant	Reject $H_{0(5)}$ - High
6	Solar connect scheme for on-grid	3.94	3	16.701	.000	Significant	Reject $H_{0(6)}$ - High
7	Effective in awareness programmes	3.39	5	5.858	.000	Significant	Reject $H_{0(7)}$ - High

* sig. @ 5 per cent
** sig. @ 1 per cent

Source: primary data
N = 315

Table 6.9 provides the information regarding the level of attitude towards government initiatives with regard to SPV penetration in Kerala. One sample t test was performed to ascertain the statistical significance difference between the score of attitude for government initiative (ATGI) with average value. Testing of hypothesis @ 1 per cent level of significance shows that there is a significant difference of attitude regarding the government initiatives (ATGI) from average. While analyzing the attitude towards government initiatives for SPV, it can be observed that p value is less than 0.01. Hence the hypothesis is rejected. There is a significant difference from the average value found at $p<0.01$ in 'Solar system will become mandatory in future' ($t=19.079$, $p=.000$, $\mu=4.08$), 'I0000 rooftop programme of ANERT was effective' ($t=7.645$, $p=.000$, $\mu=4.08$), 'Joint effort of KSEB and other government agencies with ANERT' ($t=17.821$, $p=.000$, $\mu=3.98$), 'Solar connect scheme for on-grid' ($t=16.701$, $p=.000$, $\mu=3.94$), 'Strict Government rules and regulations across the world' ($t=13.609$, $p=.000$, $\mu=3.81$), 'Effective in awareness programmes' ($t=5.858$, $p=.000$, $\mu=3.39$), 'Government has made mandatory installation of solar in various consumer categories' ($t=5.051$, $p=.000$, $\mu=2.63$).

It can be inferred that all the factors involved in ATGI dimension proved to be higher influence in actual RTPV adoption. So it can be concluded that the government programme was successful which encouraged the consumers to a behavioural change towards adopting green technologies. This reflects the findings of (Chen & Chai, 2010)**.** which clearly indicates the impact of attitude on the government role in RET penetration.

While looking at the mean score, it is observed from the table that the most influential factor for RTPV adoption was the respondents perception about 'solar system will become mandatory in future' and 'effectiveness of 10000 solar rooftop programme'. This is in resonance with an earlier study conducted by (Wiginton et al., 2010) in which he argued that large scale PV deployment is possible through careful policy measures. Further (Lynch & Martin, 2010) mentioned that penetration of energy efficient technologies can be accelerated by government intervened programmes and it will be helpful for the market transformation of decentralized technologies. The second factor of which they have a higher level of attitude is 'joint efforts of KSEB and ANERT and other government agencies for making solar

programme successful' is found to be the second most influencing factor in ATGI dimension. The third factor they have high level of attitude about is 'solar connect scheme for on-grid SPV 'following 'strict government rules and regulations across the world for uptake of solar energy', 'ANERT awareness programme'. It can further be noted that a low mean score from average value for the rules for its mandatory implementations in various consumer segments. Surprisingly, it is implied that the mandatory implementation in various customer segments all over the country didn't strengthen the level of ATGI. One possible reason for that is other government initiatives influenced them more to install SPV in their home. It is not because of compulsory implementation in other sectors. Tailor made programmes for each sector are essential in order to create a favorable attitude towards that product. So they can analyse the feasibility of the system to their own needs. However, they perceived a growth in future and the effectiveness of 10000 solar rooftop programme. It is also expected that the integrated efforts of utilitiy companies, NGO's and private sector with ANERT for making the system more affordable. In the near future, subsidy will phase out. Therefore the product must be capable of meeting the needs of the potential consumers; then only there is a scope for wide commercialization.

6.9 Perceived Usefulness (PU)

Existing literature regarding RETs adoption widely recognizes the importance of PU in solar energy system adoption and utilization. In order to know the influence of each item involved in this dimension while installing solar system, the researcher asked the respondents to rate the various factors regarding PU of the system. The study took utility factors such as uninterrupted power supply, electricity bill reduction by system use, conventional fuel saving, peak time consumption reduction, protection against rising cost of fossil fuel energy, and reduction in idle working hour due to power breakdown. One sample t test is conducted to know the effect of various factors of perceived usefulness while adopting SPV. The importance contributed by each factor involved in this dimension is measured by descriptive statistics. Hence the researcher formed a hypothesis that

H17.G $_{(1)}$ to $_{(6)}$: The effectiveness of various items/factors determining Perceived Usefulness of RTPV by residential users at the time of adoption is significant in Kerala

Table No. 6.10

One Sample t test regarding Perceived Usefulness

Sl No	PU	Mean	Rank	t	P	Decision	Discussion
1	Energy Efficiency	4.34	2	25.882	.000	Significant	Reject $H_{0(1)}$ - High
2	Conventional fuel saving	4.26	3	22.847	.000	Significant	Reject $H_{0(2)}$ - High
3	Peak time consumption Reduction	4.23	4	23.140	.000	Significant	Reject $H_{0(3)}$ - High
4	Reduction of number of working hours due to power breakdown	3.95	6	14.874	.000	Significant	Reject $H_{0(4)}$ - High
5	Uninterrupted power supply	4.57	1	40.254	.000	Significant	Reject $H_{0(5)}$ - High
6	Protection against the consequences of increased level of fossil fuel use	4.12	5	6.394	.000	Significant	Reject $H_{0(6)}$ – High

* sig. @ 5 per cent
** sig. @ 1 per cent

Source: primary data
N = 315

Table 6.10 would give results of one sample t test for measuring various factors related to perceived usefulness of RTPV among residential consumers. The results of one sample t test at 1% level of significance reveals that there and significant differences from the average value found at $p<0.01$ in 'uninterrupted power supply' ($t=40.254, p<0.01$), 'reduction of electricity bill' ($t=25.882$, $p<0.01$), 'conventional fuel saving' ($t=22.847$, $p<0.01$), 'peak time consumption reduction' ($t=23.140$, $p<0.01$), 'protection against rising cost of fossil fuel energy' ($t=6.394$,

p<0.01), and ‘reduction in idle working hour due to power breakdown’ (t=14.874, p<0.01). Hence the hypothesis is rejected as the p value is less than 0.01 and it can be concluded that there is a higher effectiveness of each factor related to PU.

By looking at descriptive analysis, it can be observed from the table that the most important influence among PU factors is ‘uninterrupted power supply’ with a mean score of 4.57. The second important influencing factor among PU is ‘reduction of electricity bill’ with a mean score of 4.34. The third important factor considered by the respondents is ‘conventional fuel saving’ with a mean score of 4.26 following ‘peak time consumption reduction’ (4.23), ‘protection against rising cost of fossil fuel energy’ (4.11), and the least important factor ‘reduction in idle working hour due to power breakdown’ with a mean score of 3.94.

6.10 Environmental Attitude/ Relative Advantage (EA/ RA)

Numerous researches proved that environmental factors have a higher priority in influencing green purchase intention and bahaviour. Environmental concern or attitude towards this solar energy product can be treated as relative advantage. It is widely recognized fact that the market of solar energy products depends on its green aspects and green credentials which are now becoming a priority for the successful positioning of the product in the minds of consumers. In order to know the level of various factors/items relating to environmental concern or relative advantage while adopting RTPV, one sample t test was adopted to find out the significance. Here respondents are asked to rate the factors regarding EA/RA on a likert five point scale in order to know the priority given by consumers while adopting the system.

Further descriptive analysis using mean score also helps to identify the most important EA/RA factor considered by respondents at the time of adoption. So in order to test the effectiveness of EA/RA on RTPV adoption, the researcher formed a hypothesis that

H17.$H_{(1)}$ to $_{(11)}$: Various factors determining EA/RA of RTPV by residential users at the time of adoption is significant

Table No. 6.11

One Sample t test Regarding Environmental Concern/Relative Advantage

Sl No	EA/RA	Mean	Rank	t	P	Decision	Discussion
1	Better quality of life	4.31	10	28.958	.000	Significant	Reject $H_{0(1)}$ High
2	To meet expectation for sustainable products	4.21	11	27.871	.000	Significant	Reject $H_{0(2)}$ - High
3	Improving public health by reducing pollution	4.57	2	11.573	.000	Significant	Reject $H_{0(3)}$ - High
4	Produce our own RE energy	4.54	3	43.325	.000	Significant	Reject $H_{0(4)}$ - High
5	Working of the system have silent operation	4.40	8	31.969	.000	Significant	Reject $H_{0(5)}$ - High
6	Demonstrate our environmental consciousness and responsibility	4.43	6	33.522	.000	Significant	Reject $H_{0(6)}$ High
7	Reduce the impacts of eco system	4.40	9	33.569	.000	Significant	Reject $H_{0(7)}$ - High
8	To be a part of green path of global development	4.49	4	36.502	.000	Significant	Reject $H_{0(8)}$ - High
9	Reduce greenhouse gas emission	4.46	5	36.576	.000	Significant	Reject $H_{0(9)}$ - High
10	Preventing global warming impacts	4.42	7	32.547	.000	Significant	Reject $H_{0(10)}$ - High
11	Reduce carbon footprint	4.59	1	9.449	.000	Significant	Reject $H_{0(11)}$ - High
* sig. @ 5 per cent ** sig. @ 1 per cent						Source: primary data N = 315	

The table 6.11 presents the results of one sample t test. The results of one sample t test at 1 per cent level of significance reveal that there are significant differences from the average value found at $p<0.01$ in all factors related to EA/RA. Hence the $H_0$17.$H_{(1)}$ to $_{(11)}$ is rejected as the p value is less than 0.01 for all factors

and it can be concluded that there is a higher effectiveness of each factor related to EA/RA. Solar energy customers are mainly influenced by the awareness about the consequences of global warming and climate change effects. Here environmental advantages of this product are taken as relative advantage of the product when compared with other non conventional sources.

It can be noted from the table that the most important influencing factor among RA/EA is reduction in carbon footprint ($t=9.449$, $p<0.01$, $\mu= 4.59$). The second important influence is improvement in public health by reducing pollution ($t=11.573$, $p<0.01$, $\mu= 4.57$). The third important influence is production of own RE energy ($t=43.325$, $p<0.01$, $\mu= 4.54$) followed by 'To be a part of green path of global development' ($t=36.502$, $p<0.01$, $\mu= 4.49$), 'Reduction of GHG' ($t=36.576$, $p<0.01$, $\mu= 4.46$), demonstration of environmental responsibility ($t=33.522$, $p<0.01$, $\mu= 4.43$) preventing global warming impacts ($t=32.547$, $p<0.01$, $\mu= 4.42$) silent operation ($t=31.969$, $p<0.01$, $\mu= 4.40$), Reduction of the impacts of eco system ($t=33.569$, $p<0.01$, $\mu= 4.40$), better quality of life ($t=28.958$, $p<0.01$, $\mu= 4.31$) and meet the expectation of sustainable products ($t=27.871$,$p<0.01$, $\mu= 4.21$). The descriptive mean value analysis clearly indicates that all factors contributing to EA/RA will have high level of influencing at the time of RTPV adoption.

This is similar to the findings of (Egbue & Long, 2012) that early adopters will accept environment-friendly products only if they perceived a relative advantage or superiority in that product vis-à-vis conventional products. Further, (Cronin et al., 2010) argue that consumers green knowledge and changing behaviour and attitude determine the success of green products. By analyzing relatively high mean values for all measures, we can conclude that Kerala SPV users are giving high priority to environmental factors. It reflects with the arguments of (Bird, 2002) that environmently conscious consumers are the best targeted segment for high priced and high quality products to avail environmental benefits. Further it should be noted that EC is now becoming a socially accepted norm

6.11 Buyer Social Responsibility (BSR)

Owing to the efforts of the Government to make a Renewable Energy (RE) intensive world, RE is projected to usher in a solution for energy dilemma. Solar

energy marketing can be put under social marketing and ethical marketing. Environmental considerations are only one dimension in socially conscious behaviour. For measuring sustainable consumption, consumer's social responsibility matters in addition to environmental concern. In addition, there are still some factors existing which are related to our energy security. So in order to become an energy independent state, the people/ residents must show some concern about the social well- being of society in addition to environmental concern. The rapid escalation in the cost of fossil fuels, dependence on other countries for oil/coal import and consequences of nuclear energy are some of the issues that should be the point of discussion among public. It is imperative to know the level of BSR factors of consumers in this time of transformation into a low carbon energy oriented economy. The purpose of this section is to determine whether BSR factors are a vital force for RTPV adoption, Therefore researcher formed a hypothesis that:

H17.I $_{(1)}$ to $_{(11)}$: The concern for factors involved in BSR dimension among Kerala RTPV residential users is significant

Table No. 6.12

One sample t test Regarding BSR

Sl No	BSR	Mean	Rank	T	p	Decision	Discussion
1	Can enhance energy security	4.5865	2	16.139	.000	Significant	Reject $H_{0(1)}$ - High
2	Role in eliminating energy poverty	4.5705	3	49.305	.000	Significant	Reject $H_{0(2)}$ - High
3	Abundant source of energy	4.5000	4	39.490	.000	Significant	Reject $H_{0(3)}$ – High
4	Reduces reliance on alternative sources of energy	4.3910	7	31.746	.000	Significant	Reject $H_{0(4)}$ -High
5	Reduces dependence on risky sources of energy	4.7244	1	7.395	.000	Significant	Reject $H_{0(5)}$ - High
6	MDG goals could be achieved	4.3333	8	30.026	.000	Significant	Reject $H_{0(6)}$ - High

7	Savings on expenses of new conventional power plants	4.2564	9	27.992	.000	Significant	Reject $H_{0(7)}$ - High
8	Reduced investments in transmission and distribution infrastructure	4.2212	10	25.096	.000	Significant	Reject $H_{0(8)}$ - High
9	Reducing rural energy poverty	4.4194	5	34.149	.000	Significant	Reject $H_{0(9)}$ - High
10	Compatiable with modern energy	4.4744	4	10.772	.000	significant	Reject $H_{0(10)}$ - High
11	Comprehensive solution for electricity	4.4071	6	34.090	.000	Significant	Reject $H_{0(11)}$ - High
* sig. @ 5 per cent ** sig. @ 1 per cent				Source: primary data N = 315			

Table 6.12 presents the results of one sample t test regarding the buyer social responsibility factors among Kerala domestic RTPV consumers. The results of one sample t test at 1 per cent level of significance reveal that there are significant differences from the average value found at $p<0.01$ in all factors related to BSR. Hence the hypothesis is rejected as the p value is less than 0.01.

It can be noted from the table that the most important influencing factor among BSR factors is Reduction of risky sources of energy ($t=7.395$, $p<0.01$, $\mu= 4.72$). Second most important factor is Enhance energy security ($t=16.139$, $p<0.01$, $\mu= 4.58$). Third important factor is Role in eliminating energy poverty ($t=49.305$, $p<0.01$, $\mu=4.57$) followed by Abundant source of energy ($t=39.49$, $p<0.01$, $\mu=4.50$) and Reducing rural energy poverty ($t=34.14$, $p<0.01$, $\mu= 4.41$), Comprehensive solution for electricity ($t=34.09$, $p<0.01$, $\mu= 4.40$), Reduction of India's reliance on alternative sources of energy ($t=31.746$, $p<0.01$, $\mu=4.39$) and MDG goals could be achieved ($t=30.026$, $p<0.01$, $\mu= 4.33$), Savings on expenses of new conventional power plants ($t=27.992$, $p<0.01$, $\mu=4.26$), and Reduced investments in transmission and distribution infrastructure ($t=25.096$, $p<0.01$, $\mu= 4.22$).

It can be concluded that consumers possess a higher level of concern for each factor related to BSR. However, more concern regarding energy security and consequences of risky energy sources and negative externalities of fossil fuels, energy and MDG relation stood last among ranked statements. This indicates that the consumers must be given more awareness regarding the relation of energy and economic development and external cost associated with fossil fuel energy.

6.12 Subjective Norm (SN)

Although there is growing concern about environment and social responsibility factors and subsequently to green energy products , majority segments of people still refuse to adopt green energy products due to uncertainty and perceived risks and high cost. The market of solar energy products still remains niche market by attracting only high end consumers. Social pressures from peer groups will also act as motivation as well as resistance factors to RTPV adoption. 'Subjective Norms' implies that a person should take into consideration or often acts on the perception based on what others think about his/her action. It is logical to think that they will seek opinion from their significant others before making a purchase decision, as it is a high involvement decision. Relevant groups influencing individual's decision may be friends, family, and collegues. So in order to measure the level of concern for the determinants towards SN, one sample t test was adopted.

Here respondents were asked to rate the factors of SN on a likert five point scale in order to know the priority given by consumers to each item while adopting the system. Further, descriptive analysis using mean score also helped to identify the most important factor considered by respondents at the time of adoption. So in order to test the effectiveness of consumers towards SN on RTPV adoption, the researcher proposed the hypothesis:

H17.J $_{(1)}$ to $_{(4)}$: The concern for the determinants regarding Subjective Norms among Kerala domestic SPV users is significant

Table No. 6.13

One sample t test Regarding SN

Sl No	SN	Mean	Rank	t	p	Decision	Discussion
1	Friends encouragements and support	2.87	3	-1.621	.106	Insignificant	Not Rejected $H_{0(1)}$ -Low
2	Colleagues encouragements and support	2.76	4	-3.058	.002	Significant	Reject $H_{0(2)}$ - Low
3	Families encouragements and support	3.27	2	3.482	.001	Significant	Reject $H_{0(3)}$ - High
4	I feel prestige among society for generating my own electricity	3.93	1	12.939	.000	Significant	Reject $H_{0(4)}$ -High
* sig. @ 5 per cent ** sig. @ 1 per cent						Source: primary data N = 315	

Table 6.13 displays the results of one sample t test and descriptive statistics regarding the determinants of subjective norms to know the relative importance of each factor. The results of one sample t test at 1 per cent and 5 per cent level of significance reveals that there are significant differences from the average in all factors related to SN except one which is 'the influence of friends'. Hence the remaining hypothesis is rejected as the p value of majority of factors is less than 0.01. The role of prestige among society as well as family support and encouragements scores high mean values which indicates that consumers have given more relevance to such aspects. However 'Friends' and collegues' support' showing a low value below average means it is not a significant influence.

The results reveal that the RTPV users in Kerala paid more attention to 'feeling prestige among society for generating own electricity' ($t=12.939$, $p<0.01$, $\mu= 3.92$). Secondly, the respondents considered 'families' encouragement and support' ($t=3.482$, $p<0.01$, $\mu= 3.27$). Thirdly, 'friend's encouragements and support' ($t=1.621$,

$p<0.05$, $\mu= 2.87$) apperas insignificant. And lastly, 'Colleagues' encouragements' ($t=3.058$, $p<0.01$, $\mu= 2.76$). This indicates that consumers gave more priority to hedonic aspects followed by families' encouragement and support, friends and lastly collegues. It also indicates they experience interpersonal influence from their institutions in which they are working. Most of the respondents ranked the hedonic aspects followed by family support. So it can imply that emotional aspects or self identity worked in RET adoption and it dominates among the consumers in Kerala. It is consistent with the findings of (Schuitema et al., 2013) who reiterated hedonic and symbolic dimensions of motivation. Hedonic refers to emotional experience derived from the usage of a new technology and symbolic refers to sense of self or social identity from the possession of a new technology. Further, he noted that SPV adoption is a behavioural response to technological innovation, so there are innovative consumer categories who are desirous of occupying the product as soon as they appear in the market and this type of consumers are known as early adopters. Moreover, the finding is also similar with self image congruency theory that states that a consumer would more likely to purchase a product only if he finds the product image matching with the self image in order to reflect their social position and express their identity to others. Consumers may prefer to have a pro- environmental identity among the society (Whitmarsh & O'Neill, 2010). As mentioned earlier, environmental consciousness is assumed as a luxury concept. The consumers may want to express their green life style among the society by adopting such green energy products. Moreover, RETs are considered as a social responsibility of individual for the local or national advantage. Installation in non- domestic institutions like offices, schools and colleges should be promoted because it clearly influences the employees and students towards green energy technology.

6.13 Level of Pre Adoption Factors on RTPV Adoption

Finally, it would be imperative to get insight about the influencing effect of the aforementioned seven dimensions on RTPV adoption, and hence, one sample t test was conducted. Descriptive analysis with mean value also worked out in order to know the relative importance of each constructs contribution towards APB exhibited by the Kerala RTPV residential users. Seven construct Awareness, Economic Factors, Attitude towards Government Initiatives, Perceived Usefulness,

Environmental Attitude/ Relative Advantage, Buyer Social Responsibility, and Subjective Norms were taken into consideration.

H 17J $_{(1)}$ to $_{(7)}$:. Pre adoption factors while adopting RTPV by the Kerala residential consumers are significant

Table No. 6.14

One Sample t test Regarding Importance of Pre adoption Dimension

Sl No	Factors	Mean	Rank	t	P	Decision	Discussion
1	Awareness	72.99	1	89.980	.000	Significant	Reject $H_{0(1)}$ - High
2	Economic	35.93	4	92.679	.000	Significant	Reject $H_{0(2)}$ - High
3	ATGI	25.91	5	75.059	.000	Significant	Reject $H_{0(3)}$ - High
4	PU	25.46	6	78.179	.000	Significant	Reject $H_{0(4)}$ - High
5	EA/RA	48.85	3	113.987	.000	Significant	Reject $H_{0(5)}$ - High
6	BSR	48.89	2	101.902	.000	Significant	Reject $H_{0(6)}$ - High
7	SN	12.82	7	41.049	.000	Significant	Reject $H_{0(7)}$ - High

* sig. @ 5 per cent
** sig. @ 1 per cent

Source: primary data
N = 315

Table 6.14 shows the results of one sample t test and descriptive statistics regarding the determinants of APB to study the relative importance of each construct. The results of one sample t test at 1 per cent level of significance reveal that there are significant differences from the average value found at $p<0.01$ in all factors and indicate an above average level. Hence the hypothesis is rejected as the p value of all factors is less than 0.01. Therefore it is assumed that the influencing effect of seven dimensions on SPV adoption is significantly higher from average level.

The results reveal that the RTPV users in Kerala paid more attention to Awareness factors with a mean score of 72.99. Secondly, the consumers give importance to Social Responsibility Factors with a mean score of 48.89. Third important factor recognized by the consumers is Environmental Attitude /Relative

Advantage with a mean score of 48.85. Fourth position goes to Economic Factors with a mean score of 35.93. Attitude towards Government Initiatives with a mean score of 25.91 stood as 5th position. Perceived Usefulness is ranked as sixth by the consumers with a mean score of 25.46 followed by Subjective Norms with a mean score 12.82 while influencing APB of SPV residential consumers of Kerala.

Post Adoption Factors

6.14 Satisfaction regarding RTPV

Satisfaction is recognized as a vital factor for the success of the product and indirectly it could affect the economic returns of the company by way of increasing profitability through higher market share through PWOM and repeat purchase behaviour. It is the emotional state of the consumer after exposure to a particular product or service which leads to either continued adoption, intention or discontinuance of that product or company and it depends on the nature of favourable or unfavourable experience he /she received. It is recognized that retaining the existing customers are more cost effective than attracting new customers. There are many factors which contribute to improved user satisfaction. It should be noted that four Ps linkage with satisfaction is a traditionally and theoretically grounded construct. Therefore in this research, the researcher identified totally six dimensions, namely 4ps, Ease of Use, Service Oriented Aspects as the main determinants to explain the construct user satisfaction.

6.15 Product Oriented Aspects (POA)

Green Product quality has a positive association with green customer satisfaction (Chang & Fong, 2010). There is a leniar relationship between perceived quality and purchase intention (Naing & Chaipoopirutana, 2014). It is the consumers judgment about the overall excellence or superiority (Bei & Chiao, 2001). Here it indicates the quality of performance of products' components. Empirical results showed a direct, indirect and mediation effect of Product quality with satisfaction, Continued Adoption Intention (CAI), Repeated Purchase Behaviour (RPB) and Positive Word of Mouth (PWOM). Marketers introduced value added features for making the product unique from competitors. Therefore it became imperative to

assess the consumer satisfaction with regard to quality of product components offered by the company. One sample t test was adopted in order to know the satisfaction level regarding the quality of product components among residential consumers of RTPV in Kerala after adoption. Here respondents are asked to rate the factors regarding product quality on a likert five point scale in order to know the satisfaction in that dimension. Further, descriptive analysis using mean score also helps to identify the most satisfied factor considered by respondents. So in order to test the satisfaction level of RTPV product- oriented aspects, the researcher formed a hypothesis that

H18.A $_{(1)}$ to $_{(6)}$: The satisfaction level regarding Product Oriented Aspects among RTPV residential users in Kerala is significant.

Table No. 6.15

One Sample t test Regarding Satisfaction of Product Features

Sl No	Product Features	Mean	Rank	t	p	Decision	Discussion
1	Quality of panel	4.30	1	30.114	.000	Significant	Reject $H_{0(1)}$ – High
2	Quality of inverter	4.05	2	20.290	.000	Significant	Reject $H_{0(2)}$ – High
3	Quality of battery	4.00	3	19.570	.000	Significant	Reject $H_{0(3)}$ – High
4	Present installed capacity	2.86	6	-2.160	.032	Significant	Reject $H_{0(4)}$ – Low
5	Enough electricity for working all my equipment as I expected	3.24	5	3.679	.000	Significant	Reject $H_{0(5)}$ – High
6	Present battery capacity is enough for my system	3.33	4	4.920	.000	Significant	Reject $H_{0(6)}$ – High
* sig. @ 5 per cent ** sig. @ 1 per cent						Source: primary data N = 315	

Table 6.15 reports the results of one sample t test conducted in connection with the satisfaction level regarding the quality of product components. It reveals a significant deviation from the average value. The results of one sample t test at 1 per cent and 5 per cent level of significance show that there are significant differences from the average value in all factors related to product quality. Hence the hypothesis is rejected as the p value of all factors is less than 0.01 and 0.05.

It should be noted that the respondents are highly satisfied with the quality of panel ($t=30.114$, $p<0.01$, $\mu= 4.30$). Secondly, with good quality of inverter ($t=20.290$, $p<0.01$, $\mu= 4.05$) following battery quality ($t=19.570$, $p<0.01$, $\mu= 4.00$) battery capacity ($t=4.920$, $p<0.01$, $\mu= 3.333$) and electricity generation as expected ($t=3.24$, $p<0.01$, $\mu= 3.24$). It should be noted that they have low level of satisfaction in the case of their present installed capacity of their system with regard to their electricity generation ($t=2.160$, $p<0.05$, $\mu=2.86$). Therefore, it can be ascertained that the 1 KW system is not enough for meeting their electricity requirements. In other words, it didn't match the expectations of consumers. One possible reason for that is the consumers may have highly trusted the claim made by ANERT that 1KW system should generate 4 units of electricity on a sunny day. However there may be various other factors which can hinder the generation of electricity.

6.16 Price

Price is perceived as a sacrifice made by the consumers for receiving a benefit. It is evaluated in the cognitive conception of consumers and the direct or indirect link with consumer satisfaction. This section helps to get an awareness about the perception of the consumers about the charged price. If it is perceived fair or reasonable, they may not be dissatisfied. Here the respondents are asked about the fairness about price charged by the company and mode of payment. So in order to test the satisfaction level towards the price charged by company among the residential users of RTPV in Kerala, the researcher formed a hypothesis that

H18.B $_{(1)}$ to $_{(2)}$: The satisfaction level towards Price charged by company among RTPV residential users in Kerala is significant

Table No. 6.16

One Sample t test Regarding Satisfaction of Price

Sl No	Factors	Mean	Rank	t	p	Decision	Discussion
1	Reasonable price for the system	3.8553	1	17.197	.000	Significant	Reject $H_{0(1)}$ - High
2	Monthly installment system will make the SPV more popular	3.8032	2	13.919	.000	Significant	Reject $H_{0(2)}$ - High
	* sig. @ 5 per cent ** sig. @ 1 per cent					Source: primary data N = 315	

Table 6.16 reports the results of one sample t test concerning the satisfaction level with regard to the price of RTPV system among the residential users. This reveals that the satisfaction level is above average. The respondents have above average level satisfaction relating to the price charged by the company ($t=17.197$, $p<0.01$, $\mu= 3.85$) and the statement seeking their opinion about monthly installment system ($t=13.919$, $p<0.01$, $\mu= 3.80$). It also throws light on the fact that they are not dissatisfied with lumpsum cash payment after subsidy availed by the consumers.

6.17 Ease of Use (EOU)

It is the individual's assessment of efforts involved in the process of using the system (Venkatesh, 2000). If consumers can operate and use a system without much effort, it is more likely to increase the product acceptance and satisfaction. Furthermore, it would also increase self efficacy which may lead to satisfaction. It should be noted that further purchase intention and behavior can be predicted by EOU. Moreover, EOU played a prominent role in innovative technology acceptance. TAM model also recognise EOU as fundamental requirement which determines one's behaviour intention and behaviour in using technology. 'Complexity' dimension of DOI theory of Roger also states that the complexity of the system will negatively affect the usage of the system. Therefore here in this section, the researcher tried to assess satisfaction regarding the ease of using RTPV by asking

statements on a five point scale. Research in Psychology and Marketing has also suggested that perception become more specific after direct experience. (Venkatesh & Davis, 1996) suggest that "subjects without direct experience in a given domain base, their perception on abstract criteria, and after direct experience, can make their judgment based on more concrete criteria." In this section, difficulty in switchover from solar to grid electricity, filling water in battery, usage without frequent failure and overall usage experience are considered as the determinants of EOU. Therefore understanding the satisfaction regarding these antecedents of EOU seems to be relevant in practical point of view because the perceived difficulty to use a system may be the underlying reason for adopting and using a technology. So in order to test the satisfaction level towards the price charged by company among the residential users of RTPV in Kerala, the researcher formed a hypothesis that:

H18.C $_{(1)}$ to $_{(4)}$: The satisfaction level towards EOU with the system among Kerala RTPV residential users is significant.

Table No. 6.17

One Sample t test Regarding EOU

Sl No	Factors	Mean	Rank	t	p	Decision	Discussion
1	I find no difficulty in switch over from solar to grid electricity as it is not automatic	2.68	4	4.489	.000	significant	Reject $H_{0(1)}$ – Low
2	I find no difficulty in filling water in battery	2.93	3	1.024	.307	Insignificant	Not Rejected $H_{0(2)}$ – Low
3	Can use without frequent failure after installation	3.76	2	13.697	.000	Significant	Reject $H_{0(3)}$ – High
4	Better Usage experience	3.92	1	19.766	.000	Significant	Reject $H_{0(4)}$ – High
* sig. @ 5 per cent ** sig. @ 1 per cent					Source: primary data N = 315		

Table 6.17 reports the results of one sample t test in connection with the satisfaction level regarding EOU of system among residential users reveals a significant deviation from the average value for three factors except one. The results of one sample t test at 1 per cent and 5 per cent level of significance shows that there are significant differences from the average value in all factors related to EOU except in 'I find no difficulty in filling water in battery'. Hence the hypothesis is rejected as the p value of majority factors is less than 0.01.

It should be noted that the respondents are highly satisfied with Better Usage experience ($t=19.776, p<0.01, \mu=3.92$) following 'Can use without frequent failure after installation' ($t=13.697, p<0.01, \mu= 3.76$). Respondents have atleast average satisfaction about difficulty in filling water in battery ($t=1.024, p<0.01, \mu= 2.93$). However they have low satisfaction level in switch over from solar to grid electricity ($t=4.489, p<0.01, \mu= 2.68$). .

6.18 Service Oriented Aspects (SOA)

Consumers' overall assessment concerning the inferiority and superiority of the service provided by the company could have a greater effect on satisfaction and subsequent behaviour. 'SOA dimension may vary on the basis of service type' (Lim, Russell-Bennett & Dagger, 2008) Empirical studies indicated that higher service quality lead to increase in customer satisfaction and subsequent behaviour. Service Quality (SQ) and Customer Satisfaction (CS) are the crux of marketing and identified as a key for sustainable competitive advantage. So it is imperative to know the satisfaction level regarding the SOA factors among the RTPV consumers in Kerala. Therefore it became imperative to assess the consumer satisfaction with regard to SOA offered by the company. As it is an innovative technological product, assurance is the most important dimension provided from the part of suppliers. Hence four statements regarding assurance and one statement from each dimension of SQ model is formed to test the respondent's satisfaction level.

Table No. 6.18

Five dimensions of service quality

Dimension	Explanation
Tangibles	Physical facilities, equipment, and appearance of personnel
Reliability	Ability to perform the promised service dependably and accurately
Responsiveness	Willingness to help customers and provide prompt service
Assurance	Knowledge and courtesy of employees and their ability to inspire trust and confidence
Empathy	Caring, individualized attention the firm provides its customers

One sample t test was adopted in order to know the satisfaction level regarding the service quality of suppliers among consumers after adopting SPV. Here respondents are asked to rate the factors regarding SOA on a likert five point scale in order to know the satisfaction in that dimension. Further descriptive analysis using mean score also helps to identify the most satisfied factor considered by respondents. So in order to test the satisfaction level towards the SOA provided by company among residential users RTPV in Kerala, the researcher formed a hypothesis that:

H18.D $_{(1) \text{ to } (9)}$: The satisfaction level towards SOA of RTPV suppliers among Kerala residential users is significant

Table No.6.19

One Sample t test Regarding SOA

Sl no	Factors	Mean	Rank	t	P	Decision	Discussion
1	Timely installation (Reliability)	3.92	3	69.689	.000	Significant	Reject $H_{0(1)}$ – High
2	Installation work done by the company (Tangibility)	4.01	2	80.104	.000	Significant	Reject $H_{0(2)}$ – High
3	Timely getting service (Responsiveness)	2.87	5	43.212	.000	Significant	Reject $H_{0(3)}$ – Low
4	There is no such situation arrived to call the company after installation for any failure (Reliability)	2.73	7	42.600	.000	Significant	Reject $H_{0(4)}$ – Low
5	Monitoring of system in every 6 months (Assurance)	2.58	8	39.788	.000	Significant	Reject $H_{0(5)}$ – Low

6	Credibility of providers (Assurance)	3.56	4	59.707	.000	Significant	Reject $H_{0(6)}$ - High
7	Not incurred any additional expenses (Assurance)	3.56	4	50.945	.000	significant	Reject $H_{0(7)}$ – High
8	It will be better if the companies does the maintenence services in every 6 months (Empathy)	4.41	1	95.626	.000	Significant	Reject $H_{0(8)}$ – High
9	Companies responsibility of reinstallation after 20 years (Assurance)	2.85	6	42.846	.000	Significant	Reject $H_{0(9)}$ – Low
* sig. @ 5 per cent ** sig. @ 1 per cent						Source: primary data N = 315	

Table 6.19 shows the results of one sample t test relating to the satisfaction level regarding Service Oriented Aspects of SPV system among residential users, which reveals a significant deviation from the average value. The results of one sample t test at 1 per cent of significance show that there are significant differences from the average value in all factors related to SOA. Hence the hypothesis is rejected as the p value of majority factors is less than 0.01. A high satisfaction was found in Empathy, Tangibility, Assurance and Responsiveness and a low level of satisfaction is found in responsiveness and three statements regarding assurance. (Choi, Lee & Kim 2005) found that tangibility is the most important factor of service quality in predicting future behaviour intention among both males and females. It should be noted that customers' satisfaction will be above average if the companies do the maintenence services in every 6 months (Emapthy)_(t=95.626, $p<0.01$, $\mu=4.41$). Secondly, Installation works done by the company (Tangibiliy) (t=80.104, $p<0.01$, $\mu=4.0129$). Thirdly, Timely installation (Reliability) (t=69.689, $p<0.01$, $\mu=3.92$ followed by Credibility of providers (Assurance) (t=59.707, $p<0.01$, $\mu=3.56$), Not incurred any additional expenses (Assurance) (t=50.945, $p<0.01$, $\mu= 3.56$). The respondents recorded a low level of satisfaction regarding Timely getting service (Responsiveness) (t=43.212, $p<0.01$, $\mu= 2.87$) Companies responsibility of reinstallation after 20 years (Assurance) (t=42.846, $p<0.01$, $\mu=2.85$), There is no situation arrived to call the company after installation for any failure (call company

for failure-Assurance) ($t=42.600$, $p<0.01$, $\mu=2.73$), Monitoring of system in every 6 months (Assurance) ($t=39.788$, $p<0.01$, $\mu=2.57$). Therefore the company should give more thrust on the responsiveness and assurance dimension

6.19 Communication/Promotion (COMN)

Promotion is one of the critical aspects in marketing success of a product. It is termed as communication when viewed from the customer side. Communication must be a two way process in which we are making sure that consumers are aware of or updated with, the features and latest information about the product. As satisfaction regarding this aspect is necessary, here, in this section, the effectiveness of communication strategies employed by the companies/ dealers is investigated. Proper communication should ensure an upward trend in sales, market share, brand recognition, information and education about a particular product and creation of a competitive market. Here 'communication aspects' means that the necessary requirements, to keep the system damage free, must be communicated clearly to a customer as they are a technological product. So a customer may look for the detailed instructions for its efficient functioning and latest updates. Topping of distilled water in batteries and cleaning dust on panels are necessary for their improved life cycle and efficient functioning.

Here, in this section, the effectiveness of communication strategies employed by the dealers /company is investigated; thus the marketers will be able to understand the satisfaction level of respondents. Meanwhile, the significance of various items in the communication dimension can be computed by conducting one sample t test and the study has formed the hypothesis.

H18.E $_{(1)}$ to $_{(4)}$: The satisfaction level regarding the communication aspects of RTPV among residential users in Kerala is significant.

Table No. 6.20

One Sample t test Regarding Satisfaction of Communication Oriented Aspects

Sl No	Factors	Mean	Rank	t	p	Decision	Discussion
1	Information about filling of water in batteries	3.70	1	10.948	.000	Significant	Reject $H_{0(1)}$ – High
2	Informed about on-grid system	2.49	5	-7.862	.000	Significant	Reject $H_{0(2)}$ – Low
3	Clean panels	3.65	2	10.680	.000	Significant	Reject $H_{0(3)}$ – High
4	Better customer support	3.41	3	6.411	.000	Significant	Reject $H_{0(4)}$ – High
5	Enough promotional activities	2.84	4	-2.603	.010	Significant	Reject $H_{0(5)}$ – Low
* sig. @ 5 per cent ** sig. @ 1 per cent					Source: primary data N = 315		

Table 6.20 demonstrates the results of one sample t test in respect of the satisfaction level regarding communication aspects of SPV system among residential users which reveal a significant deviation from the average value. The results of one sample t test at 1 per cent of significance reveal that there are significant differences from the average value found at $p<0.01$ in all factors related to communication aspects. Hence the hypothesis is rejected as the p value of majority factors is less than 0.01. It should be noted that, customers' satisfaction is found to be the highest in 'Information regarding filling of water in batteries ($t=10.948$, $p<0.01$, $\mu=3.70$), followed by cleaning of panels ($t=10.680$, $p<0.01$, $\mu=3.65$), Better customer support ($t=6.411$,$p<0.01$, $\mu=3.41$). However, satisfaction is low with respect to giving latest updates about new developments of the system ($t=7.862$, $p<0.01$, $\mu=2.49$) and promotional activities ($t=2.603$, $p<0.01$, $\mu=2.84$) which is one of the critical aspects of the marketing success of the product.

6.20 Convenience

Accessibility of suppliers becomes more important for a high involvement product. Studies emphasized that the consumers who had purchase intention are demotivated by lack of availability, inconvenience and price. Positive attitude is affected by low perceived availability. Scarcity of shops and market negatively affects the convenience required by the consumers. Thus the significance of various items in the convenience dimension can be computed by conducting one sample t test and the study formed the hypothesis.

H18.F $_{(1)}$ to $_{(3)}$: The satisfaction level regarding the convenience aspects about RTPV among residential users in Kerala is significant

Table 6.21

One Sample t test Regarding Satisfaction of Convenience related Aspects

Sl No	Factors	Mean	Rank	t	P	Decision	Discussion
1	Accessibility of company	3.21	**3**	3.113	.002	Significant	Reject $H_{0(1)}$ – High
2	Availability of authorized dealers of the company	3.56	1	8.615	.000	Significant	Reject $H_{0(2)}$ – High
3	Availability of components	3.27	2	4.715	.000	Significant	Reject $H_{0(3)}$ – High
* sig. @ 5 per cent ** sig. @ 1 per cent						Source: primary data N = 315	

Table 6.21 shows the results of one sample t test in respect of the satisfaction level concerning convenience aspects of SPV system among residential users. This study reveals a significant deviation from the average value. The results of one sample t test at 1 and 5 per cent of significance reveal that there are significant differences from the average in all factors related to communication aspects. Hence the hypothesis is rejected as the p value of all factors is less than 0.01. It should be noted that customers' satisfaction is found to be the highest in Availability of

authorized dealers of the company (t=8.615, p<0.01, μ=-3.56), followed by Availability of components (t=4.715, p<0.01, μ=3.27) and Accessibility of company (t=3.113, p<0.05, μ=3.21).

6.21 Level of Satisfaction dimensions towards RTPV among users

Here, in this section, the researcher attempts to measure the level of satisfaction regarding six dimensions (4Ps, EoU and SOA) of RTPV consumers.

H18.G $_{(1)}$ to $_{(6)}$: satisfaction regarding different attributes towards RTPV among users in Kerala is significant.

Table No. 6.22

One sample t test regarding the importance of SAT Dimensions

Sl No	Factors	Mean	Rank	t	p	Decision	Discussion
1	POA	21.79	2	14.512	.000	Significant	Reject $H_{0(1)}$ – High
2	Price	7.65	6	20.150	.000	Significant	Reject $H_{0(2)}$ – High
3	Communication	16.09	3	4.577	.000	Significant	Reject $H_{0(3)}$ – High
4	Convenience	10.03	5	6.260	.000	Significant	Reject $H_{0(4)}$ – High
5	EOU	13.29	4	8.443	.000	Significant	Reject $H_{0(5)}$ – High
6	SOA	30.48	1	12.862	.000	Significant	Reject $H_{0(6)}$ – High
* sig. @ 5 per cent ** sig. @ 1 per cent						Source: primary data N = 315	

Table 6.22 presents the results of descriptive statistics and one sample t test regarding the six dimension of Satisfaction to know the relative importance of each construct. The results of one sample t test at 1 per cent level of significance reveal that there are significant differences from the average value found at p<0.01 in all factors and indicate an above average level. Hence the hypothesis is rejected as the p

value of all factors is less than 0.01 for all constructs. Therefore it is assumed that the satisfaction level towards RTPV is high.

The results reveal that the RTPV users are more satisfied with Service Oriented Aspects with a mean score of 30.48. Secondly, product oriented aspects with a mean score of 21.79. The third satisfied dimension is found to be communication with a mean score of 16.9. Fourth position goes to EOU a mean score of 13.9. Convenience with a mean score of 10.3 stood as 5^{th} position. Price stands as sixth by the consumers with a mean score of 7.65.

Section 2

6.22 Socio demographic differences with regard to various Factors

In addition to all, the study also conducted some additional tests through a series of independent sample t tests and ANOVAs to get some additional insights. Empirical literature regarding RE adoption behaviour shed light on the socio demographic difference in some of the pre and post adoption factors. As the demographic environment of all countries, states and regions is subject to changes, it should be logical to assume that there will be significant difference in all pre and post RTPV adoption factors and this analysis will give insights about the general behaviour of target consumers before selecting strategies. As this market consists of national and international players, successful marketing of this product by understanding the socio- economic differences is a great challenge to the marketers. (Chen & Chai, 2010) found no significant difference of gender with environmental attitude. Further, (Dagher, 2015) found moderating effect of gender on relationship between Environmental Concern (EC) and attitude towards Green Purchase Behaviour (GPB). (Labay & Kinnear, 1981), (Mittal & Kamakura, 2001) confirmed a moderating effect of consumer characteristics on repurchase behaviour. They state that consumers with the same satisfaction ratings, but with different characteristics, may exhibit different levels of RPB.

6.23 Difference of demographics on Awareness regarding different solar energy products

Empirical studies have confirmed the linkage between impact of different demographic groups on 'Awareness regarding solar energy products'. There comes a strong need to examine the gender effects on the awareness of these innovative technological products because gender difference may impact on RE product awareness. Earlier studies found a higher ecologically conscious consumer behaviour score for females. So it is necessary to get an idea about gender wise impact of the selected sample on awareness regarding these energy products. Likewise age, education and income levels and occupational status may have a strong relationship with awareness. It is normal to assume that awareness varies with different segments of consumers. An attempt has been made to investigate the relationship of

demographic variables with awareness of different solar energy products. A one sample analysis of variance is used to test hypotheses about means when there are three or more groups of one independent variable. In this case, the area of residence was considered to be the independent variable, which included three areas (a) Corporation, (b) Municipality and (c) Panchayat. So ANOVA was used to compare the mean scores of area of residence, income, education, occupation, age and district. And independent sample t test is used to compare the mean scores of variables for two different groups of participants, that is, male and female. The results are shown in Table 6.23.

H_1: There is a statistically significant difference with respect to awareness regarding different types of solar energy products with demographic variables.

Table No. 6.23

Awareness regarding Solar Energy Products-Inferential Statistics

Dependent Variable : Awareness of solar energy products	Independent Variable		N	Mean	SD	F	P	Decision	Discussion
	Gender	Male	281	28.81	8.74	3.001	0.003	Significant	Hence P<0.05,H_0 Rejected
		Female	34	24.15	6.79				
	Area	Corporation	168	27.99	8.49	0.256	0.774	Insignificant	Hence p>0.05 H_0 not Rejected
		Municipality	47	28.51	10.07				
		Panchayat	100	28.75	8.32				
	Monthly Income	Below Rs.20000	40	24.15	8.36	3.664	0.006	Significant	Hence P<0.05,H_0 Rejected
		20000-30000	70	28.56	8.05				
		30000-40000	43	26.86	8.42				
		40000-50000	30	29.30	7.31				
		50000 above	132	29.68	9.08				
	Education	Undergraduate	37	25.59	8.44	2.762	0.028	Significant	Hence P<0.05,H_0 Rejected
		Graduate	85	27.39	8.67				
		PG	53	29.13	8.08				
		Diploma	16	25.19	8.76				
		Professional qualification	124	29.80	8.72				
	Occupation	Government employee	111	27.51	9.06	0.639	0.590	Insignificant	Hence p>0.05 H_0 not Rejected
		Business	60	28.32	8.56				
		Private employee	59	28.46	8.17				
		Profession	85	29.24	8.60				
	Age	20-30	6	24.83	7.17	0.873	0.455	Insignificant	Hence p>0.05 H_0 not Rejected
		31-40	33	29.58	6.93				
		41-50	53	29.26	9.38				
		50 above	223	27.99	8.76				
	District	TVM	78	28.42	9.10	0.124	0.946	Insignificant	Hence p>0.05 H_0 not Rejected
		EKM	100	28.15	8.36				
		TCR	105	28.59	8.59				
		MPM	32	27.59	9.13				

One way ANOVA and independent sample t test (at 5 per cent level of significance) were computed to test the statistical significance of the hypothesis. The result shown in Table 6.23 indicates that significant differences exist between

gender, income and education for the variable Awareness of solar energy products. It can be seen that the area of the residents of the respondents, occupation, age and district are found to have no statistically significant effect on the awareness regarding different types of solar energy products as the p value is more than 0.05. This findings contrast with (Claudy, 2000) that older people are more aware of micro generation technologies however consistent with the fact that people in employment would have more awareness about RE. The result is in contrast with the previous findings of (Wahi & Ahsan, 2012) which indicates that rural people are not aware of solar technology.

This implies that there is a significant difference related to awareness regarding different solar energy products among consumers of different gender groups ($F=3.001$, $p<0.01$), monthly income groups ($F=3.664$, $p<0.01$) and different educational levels ($F=2.762$, $p<0.05$). So we conclude that the mean score of Awareness of solar energy products differs with gender, monthly income and educational qualification. As the table shows significant difference in gender groups, the mean value indicates that male respondents ($\mu=28.8$) possess more awareness regarding these products than female respondents ($\mu=24.15$). Income- wise analysis shows that the mean awareness regarding solar energy products is high in 'Rs.50000 above' monthly income group ($\mu=29.68$) and 'Rs.40000-Rs.50000' income group ($\mu=29.30$). And the least awareness is shown by 'below Rs.20000' income group. Education- wise comparison reveals that awareness is high in professional degree holders (29.80) and least awareness shown by Diploma holders (25.19) and undergraduates group (25.59).

Since the ANOVA test indicates that significant differences exist among the different monthly income groups and different educational levels for 'Awareness of solar energy products'. Subsequent multiple comparison test using 'Tucky HSD' method was used to identify the groups that significantly differ in mean awareness regarding solar energy products and the result is exhibited in Table 6.24 and 6.25.

Table No. 6.24

Multiple Comparison Test of Awareness regarding Solar Energy Products with Income

Dependent Variable (i)	Independent Variable(j)		i-j	Significance
Awareness regarding Solar Energy Products	Below 20000	20000-30000	-4.40714*	0.010
	Below 20000	40000-50000	-5.15000*	0.013
	Below 20000	50000 above	-5.53182*	0.000

For the variable 'Awareness of solar energy products', significant difference exists between the monthly income group, viz. 'Below Rs.20000' and 'Rs.20000- Rs.30000', group 'Below Rs.20000' and 'Rs.40000- Rs.50000' as well as 'Below Rs.20000' and 'above Rs.50000'.

Table No: 6.25

Multiple Comparison Test of Awareness regarding Solar Energy Products with Education

Dependent Variable	Independent Variable		i-j	Significance
Awareness regarding Solar Energy Products	UG	Professional Qualification	-4.20379*	0.009
	Graduate	Professional Qualification	-2.4015*	0.047
	Diploma	Professional Qualification	-4.6089*	0.044

For the variable 'Awareness of solar energy products', significant difference exists among different educational categories, viz. 'UG and professional qualification' and 'graduate and professional qualification', as well as 'diploma holders and professional degree holders'.

6.24 Effectiveness of alternative information sources based on Demographic differences

RTPV adoption decision could be influenced by promotional tools employed by the companies or dealers. Traditional and online media preferences may be different with gender, age, education, income, occupation and district-wise categories**.** Different groups may perceive different media as credible sources. Hence an attempt is made to assess perception of mainstream media or alternative sources of information. Moreover, the role of media in marketing being a growing phenomenon, marketers need to know which is the most accessible medium for each segment because different consumers rely on different mainstream media. For assessing the difference between demographic variables with the perception of mainstream media, the study formed a hypothesis.

H_1: There is a significant difference between socio demographic variables with respect to the opinion regarding effectiveness towards alternative sources of information used by RTPV suppliers.

Table 6.26

Effectiveness of alternative information sources based on Demographic differences- Inferential Statistics

Dependent Variable : Media Perception	Independent Variable		N	Mean	SD	F	P	Decision	Discussion
	Gender	Male	281	17.42	4.39	1.300	0.195	Insignificant	Hence p>0.05 H_0 not rejected
		Female	34	16.38	4.26				
	Area	Corporation	168	17.25	4.12	0.822	0.440	Insignificant	Hence p>0.05 H_0 not rejected
		Municipality	47	16.70	4.63				
		Panchayath	100	17.68	4.70				
	Income	below 20000	40	17.58	4.58	1.118	0.348	Insignificant	Hence p>0.05 H_0 not rejected
		20000-30000	70	17.76	4.53				
		30000-40000	43	16.14	4.69				
		40000-50000	30	16.83	3.96				
		50000 above	132	17.47	4.23				
	Education	Undergraduate	37	17.57	4.59			Significant	Hence P<0.05,H_0
		Graduate	85	16.15	4.47				

		PG	53	17.09	4.48	2.551	0.039		Rejected
		Diploma	16	18.50	4.93				
		Professional qualification	124	17.95	4.03				
	Occupation	Government Employee	111	16.57	4.42	1.805	0.146	Insignificant	Hence $p>0.05$ H_0 not rejected
		Business	60	17.83	4.42				
		Private employee	59	17.36	4.09				
		Profession	85	17.86	4.45				
	Age	20-30	6	15.33	5.24	0.466	0.706	Insignificant	Hence $p>0.05$ H_0 not rejected
		31-40	33	17.33	4.87				
		41-50	53	17.57	4.34				
		50 above	223	17.29	4.32				
	District	TVM	78	17.69	4.37	1.046	0.373	Insignificant	Hence $p>0.05$ H_0 not rejected
		EKM	100	17.67	4.24				
		TCR	105	16.90	4.43				
		MPM	32	16.56	4.72				

One way ANOVA and independent sample t test (at 5 per cent level of significance) computed to test the statistical significance of the hypothesis show that there is a significant variation in consumer segments having different educational qualification. At the same time, there is no significant difference is found in the consumer segments belongs to different gender, areas, income, occupation, age and district.

The results of the ANOVA test depicted in Table 6.26 reveal that a statistical value of p is less than 0.05 for the variables, 'Media Perception' and Educational qualification. So we conclude that the mean score of 'Media perception' differs with educational qualification. Education- wise classification shows that the mean value of opinion regarding the effectiveness of media for getting awareness of solar energy products is high among diploma holders (μ=18.50) and the least is shown by the graduate group (μ=16.15).

Since the ANOVA test indicates that the significant difference exists among the different educational groups for media perception, the researcher conducted a post hoc test to identify which among these educational groups differs significantly and the result is exhibited in Table 6.27.

Table No. 6.27

Multiple Comparison Test-Opinion Regarding powerful media with Educational Qualification

Dependent Variable	Independent Variable		i-j	Significance
Media Effectiveness	Graduate	Diploma	-2.34706	0.048
	Graduate	Professional Qualification	-1.79867	0.004

For the variable, opinion regarding powerful media'**,** significant difference exists between the 'graduate and diploma' and 'graduate and professional qualification'.

6.25 Impact of Demographics on Choice of Suppliers

It is possible to draw some inferences related to the influencing factors or reasons for selecting the company by sample RTPV consumers. Though this programme was jointly sponsored by central and state governments, only central government accredited channel partners included in the program. Furthermore, ANERT has selected channel partners based on certain specifications. The '10000 solar rooftop power plant programme' jointly sponsored by MNRE and ANERT. ANERT selected some companies based on their specifications from MNRE accredited channel partners. The beneficiaries are free to select one company from the list based on their preferences. Here an attempt is made to investigate the determinants of consumers for selecting company for SPV adoption/implementation. With regard to influencing factors for selecting company, the researcher identified 12 variables for measurement. An attempt was made to investigate the relationship of various Demographics on Choice of Suppliers of sample RTPV consumers for selecting company for SPV implementation and the results are shown in Table No.6.28.

H_1: There is a significant difference with respect to factors affecting selection of company for RTPV installation with socio-demographics in Kerala

Table No. 6.28

Demographics on Choice of Suppliers – Inferential Statistics

Dependent Variable: Influencing factors for selecting company	Independent Variable		N	Mean	SD	F	p	Decision	Discussion
	Gender	Male	281	34.28	7.81	0.049	0.961	Insignificant	Hence $p>0.05$ H_0 not rejected
		Female	34	34.35	6.76				
	Area	Corporation	168	34.32	7.31	0.478	0.620	Insignificant	Hence $p>0.05$ H_0 not rejected
		Municipality	47	35.17	8.74				
		Panchayat	100	33.84	7.84				
	Income	Below 20000	40	34.95	7.36	1.391	0.237	Insignificant	Hence $p>0.05$ H_0 not rejected
		20000-30000	70	35.50	8.51				
		30000-40000	43	33.37	7.86				
		40000-50000	30	31.90	6.38				
		50000 above	132	34.30	7.50				
	Education	Undergraduate	37	35.65	7.62	0.803	0.524	Insignificant	Hence $p>0.05$ H_0 not rejected
		Graduate	85	34.31	8.10				
		PG	53	35.21	7.82				
		Diploma	16	34.19	7.05				
		Professional qualification	124	33.50	7.46				
	Occupation	Government Employee	111	33.70	7.61	2.167	0.092	Insignificant	Hence $p>0.05$ H_0 not rejected
		Business	60	35.03	7.38				
		Private employee	59	36.19	7.14				
		Profession	85	33.22	8.20				
	Age	20-30	6	30.33	8.80	1.831	0.141	Insignificant	Hence $p>0.05$ H_0 not rejected
		31-40	33	35.70	9.03				
		41-50	53	32.64	7.98				
		50 above	223	34.58	7.34				
	District	TVM	78	35.04	7.30	2.204	0.088	Insignificant	Hence $p>0.05$ H_0 not rejected
		EKM	100	35.40	7.50				
		TCR	105	32.90	7.80				
		MPM	32	33.59	8.39				

Independent sample t test and One way ANOVA (at 5 per cent level of significance) were computed to test the statistical significance of the hypothesis which shows that there is no significant variation towards the opinion regarding the effectiveness of media among different consumer segments.

Section 3

6.26 Influencing Factors/ Determinants for RTPV Adoption (Model constructs)

This research has given theoretical constructs to analyze the influencing factors for RTPV adoption. However, household's decision to adopt RTPV is not entirely based on rational, there may be factors other than most recognized green aspects and cost benefit analysis. The proposed model tries to study the effect of Awareness, Economic Factors, ATGI, PU, EA/RA, BSR, SN on RTPV adoption. In addition, socio-demographics of the respondents might have an influence upon these factors. Motivation behind adoption behaviour varies significantly. So it becomes relevant to analyse the effect of socio- demographics like Gender, Age, Education, Occupation, Monthly Income and Area on each factor. More importantly, an assessment of effectiveness of each factor becomes necessary in order to know the importance given by the consumers at the time of SPV adoption.

6.27 Demographics on Awareness regarding RTPV system features

Earlier studies established gender-wise difference in 'Awareness regarding RTPV system features' as it is an innovative technological product. Similarly, the latest technology awareness may vary with different age groups. Likewise, education, occupation, income, area and district may have an impact on the awareness aspects regarding RTPV. Hence it is decided to assess the influence of different demographic categories on RTPV awareness by conducting an independent sample t test and one way ANOVA**.** Therefore the study formulated a hypothesis

$H_{1:}$ There is a statistically significant difference with respect to awareness regarding RTPV with demographic variables

Table No: 6.29

Demographics on Awareness regarding RTPV system features - Inferential Statistics

Dependent Variable: Awareness Oriented Aspects	Independent Variable		N	Mean	SD	F	p	Decision	Discussion
	Gender	Male	281	41.84	12.81	2.843	0.005	Significant	Hence P<0.05 H_0 rejected
		Female	34	35.29	11.61				
	Area	Corporation	168	40.77	12.70	0.151	0.860	Insignificant	Hence p>0.05 H_0 not rejected
		Municipality	47	41.68	13.56				
		Panchayat	100	41.50	12.81				
	Income	Below 20000	40	37.70	11.58	2.201	0.069	Insignificant	Hence p>0.05 H_0 not rejected
		20000-30000	70	41.09	11.43				
		30000-40000	43	42.35	13.32				
		40000-50000	30	36.90	11.68				
		50000 above	132	42.77	13.71				
	Education	Undergraduate	37	40.27	13.44	0.544	0.703	Insignificant	Hence p>0.05 H_0 not rejected
		Graduate	85	40.34	12.87				
		PG	53	40.68	13.45				
		Diploma	16	39.06	13.92				
		Professional qualification	124	42.40	12.30				
	Occupation	Government Employee	111	40.45	12.52	0.420	0.739	Insignificant	Hence p>0.05 H_0 not rejected
		Business	69	40.28	14.17				
		Private employee	59	42.02	12.67				
		Profession	85	42.02	12.47				
	Age	20-30	6	32.83	5.19	1.856	0.137	Insignificant	Hence p>0.05 H_0 not rejected
		31-40	33	40.30	12.65				
		41-50	53	44.04	14.46				
		50 above	223	40.79	12.49				
	District	TVM	78	42.01	11.02	2.515	0.058	Insignificant	Hence p>0.05 H_0 not rejected
		EKM	100	43.27	13.05				
		TCR	105	38.54	13.57				
		MPM	32	40.84	12.83				

Independent sample t test and One way ANOVA (at 5 per cent level of significance) were computed to test the statistical significance of the hypothesis and the results show that there is significant variation between gender and RTPV

awareness. However, there is no significant variation in RTPV awareness with area, income, education, occupation, age and district. Gender -wise classification shows that RTPV awareness is higher among male respondents (41.84) than female respondents (35.29)

6.28 Demographics Effect on Economic Factors

Consumers' socio-demographic characteristics play a crucial role in determining the uptake of RTPV. Studies have identified gender, age, levels of education, occupation status, monthly income area and district may have significant difference with likelihood adoption of environmental technology. Further, an understanding about the concern regarding economic factors of the consumers is essential pre requisite for the marketers. Hence it is imperative to know if there is a significant difference among respondents in economic factors. It will be beneficial for the companies if they get a clear understanding about the differences in various consumer segments. Economic factors have been analysed on the basis of socio - demographic variables of respondents and the result of the analysis is presented in the Table 6.30. Independent sample t test was carried out to test the statistical significance of the economic factors and gender, and one way ANOVA for other demographic variables, viz. age, levels of education, occupation status, monthly income, area and district. For testing the same, the study formed a hypothesis:

H_1: There is a statistically significant difference with respect to economic factors regarding RTPV with socio-demographic variables.

Table No: 6.30

Demographic Effect on Economic Factors for RTPV adoption- Inferential Statistics

Dependent Variable: Economic Factors	Independent Variable		N	Mean	SD	F	P	Decision	Discussion
	Gender	Male	281	26.05	5.09	-0.882	0.378	Insignificant	Hence p>0.05 H_0 not rejected
		Female	34	26.85	4.34				
	Area	Corporation	168	26.17	5.05	2.204	0.112	Insignificant	Hence p>0.05 H_0 not rejected
		Municipality	47	27.36	4.28				
		Panchayat	100	25.51	5.20				
	Income	below 20000	40	26.70	5.28	2.508	0.042	Significant	Hence P<0.05 H_0 rejected
		20000-30000	70	26.49	4.68				
		30000-40000	43	26.65	4.61				
		40000-50000	30	23.47	4.75				
		50000 above	132	26.22	5.17				
	Education	Undergraduate	37	25.86	4.38	0.702	0.591	Insignificant	Hence p>0.05 H_0 not rejected
		Graduate	85	26.59	5.11				
		PG	53	26.42	5.56				
		Diploma	16	27.19	3.19				
		Professional qualification	124	25.65	5.08				
	Occupation	Government Employee	111	26.26	4.76	0.484	0.694	Insignificant	Hence p>0.05 H_0 not rejected
		Business	60	26.47	4.47				
		Private employee	59	26.36	5.55				
		Profession	85	25.59	5.34				
	Age	20-30	6	23.17	5.12	1.422	0.236	Insignificant	Hence p>0.05 H_0 not rejected
		31-40	33	25.39	5.29				
		41-50	53	25.62	4.86				
		50 above	223	26.45	4.99				
	District	TVM	78	27.05	4.66	3.561	0.015	Significant	Hence P<0.05 H_0 rejected
		EKM	100	26.84	5.00				
		TCR	105	25.03	4.85				
		MPM	32	24.97	5.78				

The result of testing of the above hypothesis at 5 per cent level shows that there is a significant difference in economic factors with income level and districts of the consumers. However no significant difference with gender, area, educational qualification, occupation and age was noticed.

Income-wise classification shows that the consideration of economic factors is high among 'below Rs.20000' income group (μ=26.70) and low in 'Rs.40000 – Rs.50000'income group (μ=23.47).All other groups were found to have slight variations regarding economic factors. District -wise analysis shows that consideration of economic factors is high in TVM (μ=27.05) and low in MLPM (μ=24.97). The mean value (μ) of economic factors of EKM and TCR is 26.84 and 25.14 respectively.

Since the ANOVA test indicates that significant difference exists among the different monthly income group and districts for economic factors, the researcher conducted multiple comparison test using Tucky to identify as to which among income groups and districts differ significantly and the result is exhibited in the Table 6.31 and 6.32.

Table No: 6.31

Multiple Comparison test- Economic Factors with Income

Dependent Variable	Independent Variable		i-j	Sig
Economic Factors	Below 20000	40000-50000	3.23333	0.007
	20000-30000	40000-50000	3.01905	0.006
	30000-40000	40000-50000	3.18450	0.007
	40000-50000	50000 above	-2.75303	1.004

Table no 6.31 indicates that there is a significant difference exists between the monthly income group 'Below Rs.20000 and Rs.20000- Rs.30000', group 'Below Rs.20000 and Rs.40000- Rs.50000' as well as below 'Below Rs.20000 and Above Rs.50000'.

Table No: 6.32

Multiple Comparison test- Economic Factors with District

Dependent Variable	Independent Variable		i-j	Sig
Economic Factors	TVM	TCR	1.90842	0.010
	TVM	MLPM	2.08253	0.046
	EKM	TCR	-1.69714	0.015

Table 6.32 shows that a significant difference exists between the districts 'TVM and TCR', 'TVM and MLPM', and 'EKM and TCR'.

6.29 Impact of demographics on Attitude towards Government Initiatives (ATGI)

Attitude affected by different demographic characteristics (Feng, 2012). ATGI has been analyzed on the basis of socio- demographic variables of respondents, viz. gender, age, levels of education, occupation status, monthly income, area and district and the result of the analysis is presented in Table 6.33. Independent sample t test was carried out to test the statistical significance of the ATGI with gender, and one way ANOVA for other demographic variables. Accordingly, the study formed a hypothesis:

H_1: There is a statistically significant difference with respect to ATGI regarding RTPV with socio demographic variables

Table No: 6.33

Impact of Demographics on ATGI

Dependent Variable: Attitude towards Government Initiatives	Independent Variable		N	Mean	SD	F	p	Decision	Discussion
	Gender	Male	281	25.85	4.87	0.336	0.737	Insignificant	Hence p>0.05 H_0 not rejected
		Female	34	25.56	3.96				
	Area	Corporation	168	25.49	4.54	1.170	0.312	Insignificant	Hence p>0.05 H_0 not rejected
		Municipality	47	26.66	4.70				
		Panchayat	100	25.97	5.16				
	Income	below 20000	40	27.70	4.37	3.426	0.009**	Significant	Hence P<0.05 H_0 rejected
		20000-30000	70	26.54	4.66				
		30000-40000	43	25.95	5.45				
		40000-50000	30	24.33	4.60				
		50000 above	132	25.16	4.58				
	Education	Undergraduate	37	28.11	4.51	4.247	0.002**	Significant	Hence P<0.05 H_0 rejected
		Graduate	85	25.35	4.48				
		PG	53	26.92	5.13				
		Diploma	16	26.06	3.77				
		Professional qualification	124	24.95	4.75				
	Occupation	Government Employee	111	25.60	4.51	1.059	0.367	Insignificant	Hence p>0.05 H_0 not rejected
		Business	60	26.72	4.40				
		Private employee	59	25.97	5.56				
		Profession	85	25.36	4.76				
	Age	20-30	6	27.50	4.46	0.283	0.838	Insignificant	Hence p>0.05 H_0 not rejected
		31-40	33	25.67	4.63				
		41-50	53	25.64	4.74				
		50 above	223	25.84	4.83				
	District	TVM	78	25.96	4.94	1.855	0.137	Insignificant	Hence p>0.05 H_0 not rejected
		EKM	100	26.58	4.68				
		TCR	105	25.03	4.45				
		MPM	32	25.69	5.42				

The result of testing of the above hypothesis at 5 per cent level shows that there is significant difference in ATGI with income (F=3.426, p=0.009) and educational level (F=4.247, p=0.002) of the consumers. However, no significant difference can be detected with gender (F=0.336, p=0.737), area (F=1.170, p=0.312), occupation (F=1.059, p=0.367), age (F=0.283, p=0.838), and district (F=1.855, p=0.137).

Income wise analysis shows that the influence of attitude towards government initiatives while adopting RTPV system is high in 'below Rs. 20000' income group (27.70) and low among 'Rs. 40000 - Rs. 50000' (24.33) income group. Education wise analysis shows that the ATGI while adopting RTPV system is high among 'under graduates' group (28.11) and low among professional degree holders (24.95). One possible reason is that higher educational attainment and income are the main determinant for PV adoption. They may have enough disposable income for spending on energy efficiency technologies and new innovations. So normally, they have higher positive attitude towards these initiatives.

Since the ANOVA test indicates that the significant differences exist among the different monthly income groups for ATGI, the researcher conducted post hoc test or multiple comparison test to identify as to which among income group differs significantly and the result is exhibited in the Table 6.34 and 6.35.

Table No: 6.34

Multiple Comparison test - ATGI with Income

Dependent Variable	Independent Variable		i-j	Significance
ATGI	Below 20000	40000-50000	3.36667	0.003
	Below 20000	50000 above	2.54091	0.003
	20000-30000	40000-50000	2.20952	0.032
	20000-30000	50000 above	1.38377	0.047

For the variable ATGI, significant difference exists between the monthly income group 'Below Rs.20000 and Rs.40000- Rs.50000' group, 'Below Rs.20000 and Rs.50000 above', group 'Rs.20000 - Rs.30000 and Rs.40000 - Rs.50000' as well as 'Rs.20000 - Rs.30000 and above Rs.50000'

Table No: 6.35

Multiple Comparison test - ATGI with Educational Qualification

Dependent Variable	Independent Variable		i-j	Significance
ATGI	UG	Graduate	2.75517	0.003
	UG	Professional Qualification	3.15650	0.000
	PG	Professional Qualification	1.97292	0.011

For the variable ATGI, significant difference exists between different educational group UG and Graduate, UG and Professional, and PG and Professional degree holders.

6.30 Impact of demographics on Perceived Usefulness (PU)

Perceived Usefulness has been analysed on the basis of socio demographic variables of respondents and the result of the analysis is presented in the Table 6.36. Independent sample t tests were carried out to test the statistical significance of the utility factors with gender, and one way ANOVA for other demographic variables. For testing the same, the study formed a hypothesis:

H: There is a significance difference between socio demographic variables with respect to various factors regarding PU**.**

Table 6.36. Demographics on PU-Inferential Statistics

Dependent Variable: Perceived Usefullness	Independent Variable		N	Mean	SD	F	P	Decision	Discussion
	Gender	Male	281	21.28	3.44	1.633	0.104	Insignificant	Hence p>0.05 H_0 not rejected
		Female	34	22.29	3.32				
	Area	Corporation	168	21.44	3.47	0.763	0.467	Insignificant	Hence p>0.05 H_0 not rejected
		Municipality	47	21.83	2.89				
		Panchayat	100	21.10	3.58				
	Income	below 20000	40	21.98	2.79	1.039	0.387	Insignificant	Hence p>0.05 H_0 not rejected
		20000-30000	70	21.70	3.38				
		30000-40000	43	20.77	3.37				
		40000-50000	30	20.77	3.16				
		50000 above	132	21.39	3.68				
	Education	Undergraduate	37	21.81	2.95	0.817	0.515	Insignificant	Hence p>0.05 H_0 not rejected
		Graduate	85	21.64	3.42				
		PG	53	21.72	2.67				
		Diploma	16	21.19	2.43				
		Professional qualification	124	20.98	3.92				
	Occupation	Government Employee	111	21.46	3.01	0.948	0.418	Insignificant	Hence p>0.05 H_0 not rejected
		Business	60	21.87	2.88				
		Private employee	59	21.46	3.73				
		Profession	85	20.92	4.02				
	Age	20-30	6	22.83	2.40	0.421	0.738	Insignificant	Hence p>0.05 H_0 not rejected
		31-40	33	21.12	3.50				
		41-50	53	21.42	3.32				
		50 above	223	21.39	3.47				
	District	TVM	78	21.71	3.20	0.750	0.523	Insignificant	Hence p>0.05 H_0 not rejected
		EKM	100	21.57	3.23				
		TCR	105	21.15	3.64				
		MPM	32	20.84	3.84				

The result of testing of the above hypothesis at 5 per cent level shows that there is no significant difference in PU with demographic variables. The findings contradict with Feng, H. Y. (2012) that gender has significant relation with usability of RET and states that male gives more importance to utility aspects of RETs than

female. However, it goes with his another finding that income is not significant factor for usability of RETs.

6.31 Effect of Demographics on EA/RA (Environmental Attitude/Relative Advantage)

Since 1970, the quality environment became a relevant public issue, a number of researchers attempted to measure the public's attitude towards environment-friendly products. EA/RA has been analysed on the basis of socio -demographic variables of respondents and the result of the analysis is presented in the Table 6.37. Independent sample t test was carried out to test the statistical significance of the EA/RA with gender, and one way ANOVA for other demographic variables. For testing the same, the study formed a hypothesis:

H_1: There is a significance difference between socio demographic variables with respect to various factors regarding EA/RA

Table No: 6.37

Demographics on EA/RA- Inferential Statistics

Dependent Variable: Environmental Attitude	Independent Variable		N	Mean	SD	F	p	Decision	Discussion
	Gender	Male	281	48.54	6.09	0.336	0.737	Insignificant	Hence p>0.05 H_0 not rejected
		Female	34	48.18	5.46				
	Area	Corporation	168	48.61	6.00	0.184	0.832	Insignificant	Hence p>0.05 H_0 not rejected
		Municipality	47	48.74	6.09				
		Panchayat	100	48.21	6.06				
	Income	below 20000	40	47.68	5.79	2.683	0.032	Significant	Hence P<0.05 H_0 rejected
		20000-30000	70	48.86	5.89				
		30000-40000	43	46.70	6.16				
		40000-50000	30	46.97	5.76				
		50000 above	132	49.51	6.01				
	Education	Undergraduate	37	46.62	6.80	1.825	0.124	Insignificant	Hence p>0.05 H_0 not rejected
		Graduate	85	48.01	5.85				
		PG	53	48.89	5.31				
		Diploma	16	47.63	6.61				
		Professional qualification	124	49.35	6.01				

	Occupation	Government Employee	111	48.77	5.48	0.671	0.571	Insignificant	Hence $p>0.05$ H_0 not rejected
		Business	60	47.58	6.40				
		Private employee	59	49.00	6.30				
		Profession	85	48.47	6.24				
	Age	20-30	6	43.83	6.77	1.852	0.138	Insignificant	Hence $p>0.05$ H_0 not rejected
		31-40	33	48.09	6.34				
		41-50	53	49.58	6.01				
		50 above	223	48.43	5.92				
	District	TVM	78	49.27	6.10	0.989	0.398	Insignificant	Hence $p>0.05$ H_0 not rejected
		EKM	100	48.76	5.60				
		TCR	105	47.81	6.07				
		MPM	32	48.13	6.88				

The result of testing of the above hypothesis at 5 per cent level shows that there is no significant variation in the factors regarding Environmental Attitude with demographic characteristics except income. Income-wise analysis shows that EA/RA is high among 'Rs.50000 above' income group (49.51) and low among 'Rs.30000-Rs.40000'income group (46.70). This is in contrast with the findings of (Fransson & Garling, 1999) that younger, more educated individuals living in urban areas are most environmentally concerned. Further, analysis of (Shen & Saijo, 2008) reveals that age has a positive correlation with individual EC. Surprisingly, it is found in contrast with most of the previous studies that the older generation is more concerned about environment than younger ones and women are less concerned than men. Likewise, the results showed a positive relation with high household income and high education level. However this matches with the findings of (Samdahl & Robertson, 1989) that socio demographic variables were ineffective in explaining environmental concern. This is similar with the findings of (Chen & Chai, 2010) that environment factors didn't contribute significantly towards consumer attitude on green products. The supportiveness of this hypothesis matches the arguments made by (Schlegelmilch, Bohlen & Diamantopoulos, 1996) that environmental consciousness depends more on situational characteristics rather than socio-demographic idiosyncrasies. They also argued about the limited utility in the use of socio demographics for profiling environmentally conscious consumers. Further, he stated that environment is not a marginal issue, hence high level of environment

consciousness is supposed to reflect in certain consumer segments of the society. Furthermore, this is in contrast with the arguments made by (Dunlap & Van Liere, 2008) argues that the supportiveness of social class hypothesis, residence hypothesis, gender and age hypothesis. (Dunlap, 975) argues about social class hypothesis relying on Maslow's theory (1970) of hierarchy of needs which assumes that the environmental consciousness is a luxury concept which can be perceived by the consumers only after satisfaction of basic material needs. Further, Morrisson et al, 1972, used the concept of relative deprivation in which they state that lower class people are familiar with poor physical conditions, and working environment and so they are less aware about their environment. Conversely, middle and upper class people cope with better environmental conditions and consequently, they more concerned about their environment deterioration. Dunlap, 1978 gives explanation to the residence hypothesis that environmental concern more found in urban residents because they are generally exposed to higher levels of pollution and rural residents possess a utilitarian orientation toward natural environment because of their occupations related with extractive nature. So they naturally are less concerned with environment. However, this study doesn't show significant difference between EA/RA with any of demographic characteristics even though a large portion of literature supports the demographical difference and EA. One of the possible explanations is that these respondents already adopted solar energy product. So they already may possess environmental concern.

Since the ANOVA test indicates that significant differences exist among the different monthly income groups for EA, the researcher conducted post hoc test or multiple comparison test to identify as to which among income group differs significantly and the result is exhibited in the Table 6.38.

Table No. 6.38

Multiple Comparison test - EA with Income

Dependent Variable	Independent Variable		i-j	Sig
EA	30000-40000	50000 above	-2.80990	0.008
	40000-50000	50000 above	-2.54091	0.036

For the variable EA, significant difference exists between the income group Rs.30000- Rs.40000 and Rs.50000 above, Rs.40000- Rs.50000 and above Rs. 50000.

6.32 Effect of demographics on Buyer Social Responsibility (BSR)

The various factors regarding BSR have been analysed on the basis of socio-demographic variables of respondents and the result of the analysis is presented in the table 6.39. Independent sample t test was carried out to test the statistical significance of the BSR factors with gender, and one way ANOVA for other demographic variables. For testing the same, the study formed a hypothesis.

H_1: There is a statistically significance difference between socio demographic variables with respect to various factors regarding BSR

Table No: 6.39

Demographics on BSR- Inferential Statistics

Dependent Variable: BSR	Independent Variable		N	Mean	SD	F	p	Decision	Discussion
	Gender	Male	281	48.29	6.06	-0.195	0.846	Insignificant	Hence p>0.05 H_0 not rejected
		Female	34	48.50	5.33				
	Area	Corporation	168	48.51	5.71	0.217	0.805	Insignificant	Hence p>0.05 H_0 not rejected
		Municipality	47	48.26	6.22				
		Panchayat	100	48.01	6.34				
	Income	Below 20000	40	46.63	6.04	1.257	0.287	Insignificant	Hence p>0.05 H_0 not rejected
		20000-30000	70	48.99	5.77				
		30000-40000	43	47.98	6.01				
		40000-50000	30	47.77	6.06				
		50000 above	132	48.70	6.01				

	Education	Undergraduate	37	46.49	5.88	1.674	0.156	Insignificant	Hence $p>0.05$ H_0 not rejected
		Graduate	85	48.45	6.15				
		PG	53	48.23	5.92				
		Diploma	16	46.56	6.54				
		Professional qualification	124	49.02	5.77				
	Occupation	Government Employee	111	48.09	5.93	0.412	0.744	Insignificant	Hence $p>0.05$ H_0 not rejected
		Business	60	47.90	6.40				
		Private employee	59	49.00	5.74				
		Profession	85	48.41	5.94				
	Age	20-30	6	45.67	7.06	0.565	0.639	Insignificant	Hence $p>0.05$ H_0 not rejected
		31-40	33	47.91	5.54				
		41-50	53	48.02	6.90				
		50 above	223	48.51	5.79				
	District	TVM	70	48.76	5.90	1.228	0.299	Insignificant	Hence $p>0.05$ H_0 not rejected
		EKM	100	48.94	5.57				
		TCR	105	47.48	6.10				
		MPM	32	48.00	6.87				

Surprisingly, the result of testing of the above hypothesis at 5 per cent level shows that there is no significant variation in factors regarding BSR with demographic characteristics. Hence hypothesis is accepted as the p value is more than 0.05 with regard to BSR with demographic characteristics. Most of the earlier studies argued that socially or environmentally conscious consumers belong to higher income category with high educational level and with prestigious occupation. One possible reason for the supportiveness of the hypothesis is that the people of Kerala are well educated and are aware of consequences of unsustainable consumption of resources. Especially the respondents are already green energy product users which involves a high investment.

6.33 Effect of Demographics on Subjective Norms (SN)

Various factors regarding SN have been analysed on the basis of socio-demographic variables of respondents and the result of the analysis is presented in the Table 6.40. Independent sample t test was carried out to test the statistical significance of the SN factors with gender, and one way ANOVA for other demographic variables. The result of these inferential statistics will help to gain a

detailed understanding about up to what extent SN can be influenced by socio demographic categories. For testing the same, the study formed a hypothesis:

H_1: There is a significance difference between socio-demographic variables with respect to various factors regarding SN.

Table No. 6.40
Demographics on SN - Inferential Statistics

Dependent Variable: Subjective Norms	Independent Variable		N	Mean	SD	F	p	Decision	Discussion
	Gender	Male	281	8.95	3.79	0.356	0.722	Insignificant	Hence p>0.05 H_0 not rejected
		Female	34	8.71	3.75				
	Area	Corporation	168	8.93	3.76	1.776	0.171	Insignificant	Hence p>0.05 H_0 not rejected
		Municipality	47	9.77	3.66				
		Panchayat	100	8.51	3.83				
	Income	below 20000	40	9.70	3.96	0.789	0.533	Insignificant	Hence p>0.05 H_0 not rejected
		20000-30000	70	9.06	3.93				
		30000-40000	43	8.70	4.08				
		40000-50000	30	8.17	3.42				
		50000 above	132	8.86	3.62				
	Education	Undergraduate	37	9.54	3.95	0.770	0.545	Insignificant	Hence p>0.05 H_0 not rejected
		Graduate	85	8.42	3.93				
		PG	53	8.87	3.61				
		Diploma	16	8.56	3.65				
		Professional qualification	124	9.15	3.73				
	Occupation	Government Employee	111	8.64	3.73	0.427	0.734	Insignificant	Hence p>0.05 H_0 not rejected
		Business	60	9.25	3.84				
		Private employee	59	8.86	3.94				
		Profession	85	9.11	3.73				
	Age	20-30	6	9.50	2.26	1.127	0.338	Insignificant	Hence p>0.05 H_0 not rejected
		31-40	33	8.33	3.65				
		41-50	53	8.26	3.62				
		50 above	223	9.15	3.86				
	District	TVM	78	9.79	3.32	3.328	0.020	Significant	Hence P<0.05 H_0 Rejected
		EKM	100	9.23	3.93				
		TCR	105	8.21	3.98				
		MPM	32	8.19	3.18				

The result of testing of the above hypothesis at 5 per cent level shows that there is significant difference in SN with districts of the consumers. However, no significant difference can be seen with gender, area, educational qualification, occupation and age. This is in contrast with the contention of (Venkatesh, 2000) who noted a significant gender difference in peer influence and stated that women are more driven by SN factors in the context of sustainable technology acceptance, adoption and usage by individuals. They argued that women are more influenced by SN perception whereas it didn't influence men's decision. Furthermore, (Gardner, & Steinberg, 2005) found peer influence on risky decision making and stated that risky decision making decreased with age and a strong effect of peer groups was found in adolescents and youths than adults. So this is similar to the present finding that peer influence was not played a significant role in risky decision making during adult stage. However, they also suggested that peer effects on cost and benefit aspects were greater among males than females.

Since the ANOVA test indicates that the significant difference exists among districts of consumer for SN, the researcher conducted post hoc test or multiple comparison test to identify which districts differs significantly and the result is exhibited in the Table 6.41.

Table No. 6.41

Multiple Comparison test - SN with District

Dependent Variable	Independent Variable		i-j	Sig
SN	TVM	TCR	-1.58535	0.005
	TVM	MLPM	-1.60737	0.041

Table 6.41 shows that significant difference exists between the districts TVM and TCR, TVM and MLPM. District-wise analysis shows that the effect of SN is more in TVM district (9.79) and low in MLPM district (8.19).

Section 4

6.34 Socio-demographic wise Classification of Satisfaction with regard to quality of RTPV

Table 6.42 provides the results regarding socio- demographics classification of satisfaction of product quality among respondents.

H_1: There is a significant difference between socio-demographic variables with respect to satisfaction regarding Quality with RTPV.

Table No. 6.42

Demographics on Satisfaction with RTPV Quality

Dependent Variable: Products Oriented Aspects	Independent Variable		N	Mean	SD	F	p	Decision	Discussion
	Gender	Male	281	18.97	3.89	0.038	0.970	Insignificant	Hence p>0.05 H_0 not rejected
		Female	34	18.94	3.77				
	Area	Corporation	168	19.16	3.83	0.696	0.499	Insignificant	Hence p>0.05 H_0 not rejected
		Municipality	47	19.06	3.68				
		Panchayat	100	18.59	4.04				
	Income	Below 20000	40	19.33	3.69	0.578	0.679	Insignificant	Hence p>0.05 H_0 not rejected
		20000-30000	70	18.96	3.47				
		30000-40000	43	18.21	3.31				
		40000-50000	30	19.37	3.79				
		50000 above	132	19.02	4.32				
	Education	Undergraduate	37	20.14	2.47	2.050	0.087	Insignificant	Hence p>0.05 H_0 not rejected
		Graduate	85	18.54	4.00				
		PG	53	19.43	4.04				
		Diploma	16	17.31	4.19				
		Professional qualification	124	18.92	3.95				
	Occupation	Government Employee	111	18.40	4.25	1.534	0.206	Insignificant	Hence p>0.05 H_0 not rejected
		Business	60	19.08	3.50				
		Private employee	59	19.03	4.20				
		Profession	85	19.58	3.31				
	Age	20-30	6	17.17	6.05	0.643	0.588	Insignificant	Hence p>0.05 H_0 not rejected
		31-40	33	18.73	3.57				
		41-50	53	18.72	3.95				
		50 above	223	19.11	3.85				
	District	TVM	78	18.1	4.51	2.035	0.109	Insignificant	Hence p>0.05 H_0 not rejected
		EKM	100	19.31	3.87				
		TCR	105	19.39	3.16				
		MPM	32	18.50	4.17				

The result of testing the above hypothesis at 5 per cent level shows that there is no significant variation in the satisfaction level regarding PROQLTY factors with demographic variables**.**

6.35 Socio demographic wise Classification of Satisfaction with regard to cost/ price of RTPV

Table 6.43 provides the results regarding socio demographic classification of satisfaction with regard to cost/price of RTPV among respondents.

H_1: There is a significant difference between socio demographic variables with respect to satisfaction regarding price of RTPV.

Table No. 6.43

Impact of Demographics on Satisfaction with price of RTPV

Dependent Variable: Price Oriented Aspects	Independent Variable		N	Mean	SD	F	p	Decision	Discussion
	Gender	Male	281	3.85	0.88	-0.363	0.717	Insignificant	Hence $p>0.05$ H_0 not rejected
		Female	34	3.91	0.83				
	Area	Corporation	168	3.86	0.85	1.945	0.145	Insignificant	Hence $p>0.05$ H_0 not rejected
		Muncipality	47	4.06	0.84				
		Panchayath	100	3.76	0.91				
	Income	Below 20000	40	4.10	0.74	1.043	0.385	Insignificant	Hence $p>0.05$ H_0 not rejected
		20000-30000	70	3.76	0.92				
		30000-40000	43	3.86	0.77				
		40000-50000	30	3.90	0.84				
		50000 above	132	3.83	0.92				
	Education	Undergraduate	37	3.86	0.79	0.928	0.448	Insignificant	Hence $p>0.05$ H_0 not rejected
		Graduate	85	3.93	0.81				
		PG	53	4.00	0.98				
		Diploma	16	3.69	0.87				
		Professional qualification	124	3.77	0.89				
	Occupation	Government employee	111	3.74	0.95	2.145	0.095	Insignificant	Hence $p>0.05$ H_0 not rejected
		Business	60	4.07	0.71				
		Private employee	59	3.95	0.82				
		Profession	85	3.81	0.89				
	Age	20-30	6	4.17	0.75	1.729	0.161	Insignificant	Hence $p>0.05$ H_0 not rejected
		31-40	33	4.12	0.78				
		41-50	53	3.72	0.91				
		50 above	223	3.85	0.88				
	District	TVM	78	3.83	0.90	0.044	0.988	Insignificant	Hence $p>0.05$ H_0 not rejected
		EKM	100	3.87	0.95				
		TCR	105	3.88	0.76				
		MPM	32	3.84	0.95				

The result of testing of above hypothesis at 5 per cent level shows that there is no significant variation in the satisfaction level regarding Price with demographic variables.

6.36 EOU Vs SD

The various factors regarding EOU have been analysed on the basis of socio - demographic variables of respondents and the result of the analysis is presented in the Table 6.43. Independent sample t test was carried out to test the statistical significance of the EOU factors and gender and one way ANOVA for other demographic variables. The result of these inferential statistics will help to gain a detailed understanding about socio- demographic differences in satisfaction regarding EOU Factors. For testing the same, the study formed a hypothesis:

H_1: There is a significant difference between socio-demographic variables with respect to satisfaction regarding EOU with SPV.

Table No. 6.44
Impact of Demographics on EOU-Inferential Statistics

Dependent Variable: Product Usage Aspects	Independent Variable		N	Mean	SD	F	p	Decision	Discussion
	Gender	Male	281	5.67	2.10	1.222	0.223	Insignificant	Hence p>0.05 H_0 not rejected
		Female	34	5.21	2.17				
	Area	Corporation	168	5.87	2.04	2.529	0.081	Insignificant	Hence p>0.05 H_0 not rejected
		Municipality	47	5.28	2.05				
		Panchayat	100	5.37	2.21				
	Income	Below 20000	40	5.13	2.14	1.248	0.291	Insignificant	Hence p>0.05 H_0 not rejected
		20000-30000	70	5.37	2.12				
		30000-40000	43	5.67	1.71				
		40000-50000	30	5.83	2.21				
		50000 above	132	5.84	2.17				
	Education	Undergraduate	37	5.32	1.73	1.392	0.237	Insignificant	Hence p>0.05 H_0 not rejected
		Graduate	85	5.76	2.32				
		PG	53	5.53	2.11				
		Diploma	16	4.63	2.28				
		Professional qualification	124	5.78	2.01				
	Occupation	Government Employee	111	5.50	2.23	1.208	0.307	Insignificant	Hence p>0.05 H_0 not rejected
		Business	60	5.72	1.99				
		Private employee	59	5.31	2.08				
		Profession	85	5.93	2.02				
	Age	20-30	6	6.00	1.10	0.498	0.684	Insignificant	Hence p>0.05 H_0 not rejected
		31-40	33	5.52	2.25				
		41-50	53	5.34	2.13				
		50 above	223	5.70	2.10				
	District	TVM	78	5.33	2.20	2.134	0.096	Insignificant	Hence p>0.05 H_0 not rejected
		EKM	100	5.47	2.17				
		TCR	105	6.04	1.91				
		MPM	32	5.44	2.17				

The result of testing the hypothesis at 5 per cent level shows that there is no significant variation in the satisfaction level regarding EOU with demographic variables. This is contradictory with the findings of (Venkatesh, & Morris, 2000) that perceived ease of use was more salient on women compared with men. The result also contradicts with the notion (Hackbarth, et al., 2003) that education and age have a significant role in perceived Ease of Use. They argued that on the basis of previous studies, older people may feel a reduction in cognitive capabilities which may lead to lower perception of self efficacy or capability to learn. So there may be chances for avoiding a technology which may perceive as difficult by older people due to this meta cognitive belief. Furthermore, they argued that early adopters of technology should have more knowledge and higher levels of education because they need to understand about how to use that particular technology appropriately which also throws light on the fact that complex technology needs more knowledge.

6.37 Demographic Effect on Satisfaction on Service Oriented Aspects

Heterogeneity is common in case of performance from suppliers and perceptions of consumers because individual consumers perceive service differently. Some of the previous empirical studies throw light on the gender and age differences in SQ dimensions in different industries (Murray, & Crilley, 1999), (Choi, Lee & Kim, 2005), (Lee, Kim, Ko, & Sagas, 2011), (Lim, Russell-Bennett, & Dagger, 2008). The levels of satisfaction may be different in diverse demographic segments. So in this section, an investigation is made to study the link between demographic characteristics and level of satisfaction. Independent sample t test was carried out to test the statistical significance of the SOA factors with gender, and one way ANOVA for other demographic variables, viz. age, levels of education, occupation status, monthly income and area.

H_1: There is a significant difference between socio- demographic variables with respect to satisfaction regarding SOA dimensions with SPV.

Table No. 6.45

Impact of Demographics on SOA-Inferential Statistics

Dependent Variable: Service Oriented Aspects	Independent Variable		N	Mean	SD	F	p	Decision	Discussion
	Gender	Male	281	20.49	4.25	1.133	0.258	Insignificant	Hence $p>0.05$ H_0 not rejected
		Female	34	19.65	2.50				
	Area	Corporation	168	20.37	3.95	0.153	0.858	Insignificant	Hence $p>0.05$ H_0 not rejected
		Municipality	47	20.17	4.30				
		Panchayat	100	20.56	4.31				
	Income	below 20000	40	20.48	3.43	1.576	0.180	Insignificant	Hence $p>0.05$ H_0 not rejected
		20000-30000	70	21.10	4.05				
		30000-40000	43	19.16	3.95				
		40000-50000	30	20.03	4.53				
		50000 above	132	20.49	4.23				
	Education	Undergraduate	37	20.70	3.41	1.065	0.374	Insignificant	Hence $p>0.05$ H_0 not rejected
		Graduate	85	20.28	4.13				
		PG	53	20.96	4.41				
		Diploma	16	18.63	3.95				
		Professional qualification	124	20.38	4.15				
	Occupation	Government Employee	111	20.41	4.45	0.228	0.877	Insignificant	Hence $p>0.05$ H_0 not rejected
		Business	60	20.77	4.09				
		Private employee	59	20.24	4.02				
		Profession	85	20.25	3.75				
	Age	20-30	6	17.67	5.47	1.006	0.390	Insignificant	Hence $p>0.05$ H_0 not rejected
		31-40	33	20.24	3.66				
		41-50	53	20.25	4.04				
		50 above	223	20.53	4.15				
	District	TVM	78	20.64	4.61	0.384	0.765	Insignificant	Hence $p>0.05$ H_0 not rejected
		EKM	100	20.58	4.45				
		TCR	105	20.07	3.50				
		MPM	32	20.34	3.59				

The result of testing the above hypothesis at 5 per cent level shows that there is no significant variation in satisfaction regarding SOA dimensions with demographic characteristics. Hence hypothesis is accepted as the p value is more than 0.05 with regard to SOA with demographic characteristics. This is contradictory

with the findings of (Murray & Crilley, 1999), (Choi, Lee & Kim 2005), which emphasized that levels of satisfaction regarding SQ varied with basic demographic characteristics. Further they state that older people may be more satisfied with the SOA aspects because of realistic expression based on their accumulated experience. (Lee, Kim, Ko & Sagas, 2011) argued that empathy and tangibility were critical SOA dimensions in determining satisfaction of both males and females. Males showed higher quality perceptions in tangibles whereas females showed higher levels of quality perceptions in empathy. The findings will provide insights into the more satisfied dimension of SOA; thus the suppliers can give more concentration to the less satisfied aspects. Additionally, demographic-based differences in SOA satisfaction rating may improve the delivery of efficient services. Further tangibility was the only dimension found to be the significant predictor for revisit intention for women. At the same time, Responsiveness, tangible, and empathy were equally important for men. Similarly, males rely more on personal cues than non- personal cues, like advertisements, packaging, etc. So they are of the opinion that women are more sensitive to the quality of service environment. It is noteworthy that the satisfaction level regarding SOA reported by different segments of consumers shows insignificant result.

6.38 Socio demographic wise Classification of Satisfaction with regard to Communication

Table 6.46 provides the results regarding socio-demographic classification of satisfaction with regard communication aspects among respondents.

H_1: There is a significant difference between socio demographic variables with respect to satisfaction regarding communication aspects.

Table No: 6.46

Demographics on Satisfaction with communication aspects

Dependent Variable: Communication Related Aspects	Independent Variable		N	Mean	SD	F	p	Decision	Discussion
	Gender	Male	281	16.09	4.30	0.197	0.844	Insignificant	Hence $p>0.05$ H_0 not rejected
		Female	34	16.24	3.20				
	Area	Corporation	168	16.08	4.07	0.651	0.522	Insignificant	Hence $p>0.05$ H_0 not rejected
		Municipality	47	16.70	3.75				
		Panchayat	100	15.86	4.57				
	Income	below 20000	40	17.05	3.55	1.027	0.393	Insignificant	Hence $p>0.05$ H_0 not rejected
		20000-30000	70	16.36	4.19				
		30000-40000	43	15.67	4.03				
		40000-50000	30	15.23	4.30				
		50000 above	132	16.02	4.37				
	Education	Undergraduate	37	16.16	4.18	1.366	0.246	Insignificant	Hence $p>0.05$ H_0 not rejected
		Graduate	85	16.39	4.35				
		PG	53	16.91	4.43				
		Diploma	16	14.56	3.63				
		Professional qualification	124	15.74	4.00				
	Occupation	Government Employee	111	15.33	4.66	2.313	0.076	Insignificant	Hence $p>0.05$ H_0 not rejected
		Business	60	16.18	4.20				
		Private employee	59	16.97	3.93				
		Profession	85	16.45	3.56				
	Age	20-30	6	14.17	2.32	0.441	0.724	Insignificant	Hence $p>0.05$ H_0 not rejected
		31-40	33	16.24	3.70				
		41-50	53	16.13	4.16				
		50 above	223	16.13	4.31				
	District	TVM	78	15.72	4.76	0.916	0.433	Insignificant	Hence $p>0.05$ H_0 not rejected
		EKM	100	16.51	4.18				
		TCR	105	16.23	3.41				
		MPM	32	15.34	4.99				

The result of testing the above hypothesis at 5 per cent level shows that there is no significant variation in satisfaction regarding communication dimension with demographic characteristics.

6.39 Socio demographic wise Classification of Satisfaction with regard to Convenience

Table 6.45 provides the results regarding socio-demographic classification of satisfaction with regard to convenience aspects among respondents.

H_1: There is a significant difference between socio demographic variables with respect to satisfaction regarding convenience.

Table No. 6.47

Impact of Demographics on Satisfaction with convenience aspects

Dependent Variable: Distribution Related Aspects	Independent Variable		N	Mean	SD	F	p	Decision	Discussion
	Gender	Male	281	13.80	3.58	-0.827	0.409	Insignificant	Hence p>0.05 H_0 not rejected
		Female	34	14.32	2.78				
	Area	Corporation	168	13.87	3.31	1.052	0.350	Insignificant	Hence p>0.05 H_0 not rejected
		Municipality	47	14.45	3.15				
		Panchayat	100	13.55	3.94				
	Income	below 20000	40	14.70	2.51	1.233	0.297	Insignificant	Hence p>0.05 H_0 not rejected
		20000-30000	70	14.23	3.24				
		30000-40000	43	13.47	3.40				
		40000-50000	30	13.27	3.57				
		50000 above	132	13.66	3.87				
	Education	Undergraduate	37	14.24	2.99	1.832	0.122	Insignificant	Hence p>0.05 H_0 not rejected
		Graduate	85	14.09	3.35				
		PG	53	14.66	3.72				
		Diploma	16	13.06	3.15				
		Professional qualification	124	13.33	3.64				
	Occupation	Government Employee	111	13.50	3.78	1.089	0.354	Insignificant	Hence p>0.05 H_0 not rejected
		Business	60	14.28	3.37				
		Private employee	59	14.32	3.50				
		Profession	85	13.68	3.20				
	Age	20-30	6	11.83	4.45	0.926	0.428	Insignificant	Hence p>0.05 H_0 not rejected
		31-40	33	13.91	2.84				
		41-50	53	14.26	3.40				
		50 above	223	13.80	3.59				
	District	TVM	78	13.81	3.92	0.126	0.945	Insignificant	Hence p>0.05 H_0 not rejected
		EKM	100	13.74	3.52				
		TCR	105	13.90	3.01				
		MPM	32	14.16	4.01				

The result of testing the above hypothesis at 5 per cent level shows that there is no significant variation in satisfaction regarding convenience dimension with demographic characteristics.

6.40 Effect of Demographics on Outcome Variables (RPB)

Theoretical arguments which provide insight throw light on the fact that satisfaction leads to continued adoption intention and subsequent RPB and PWOM, which are the two forms of loyalty, is an outcome of Continued Adoption Intention. (Stank et al., 1999) loyalty has been described as repeat purchase behavior**.** Customer loyalty can lower costs and increase profitability (Jacoby & Kyner, 1973).

Oliver (1997, p.392) defined customers' loyalty as "a deeply held commitment to re-buy or re-patronize a preferred product or service, consistently in the future, despite situational influences and marketing efforts having the potential to cause switching behaviour." The cost of recruiting a new customer is said to be five times more than the cost of keeping an existing customer (Bansky, 1994). Studies have recognized that 5 per cent increase in customer retention can generate a profit growth of 25-95 per cent across a range of industries (Reichheld, 1996).

H_1: There is a significant difference between socio demographic variables with respect to RPB of RTPV consumers

Table No. 6.48

Impact of Demographics on RTPV Repurchase Behaviour-Inferential Statistics

Dependent Variable: Repurchase Intention	Independent Variable		N	Mean	SD	F	P	Decision	Discussion
	Gender	Male	281	11.94	2.47	-0.340	0.734	Insignificant	Hence $p>0.05$ H_0 not rejected
		Female	34	12.09	2.39				
	Area	Corporation	168	11.77	2.34	1.346	0.262	Insignificant	Hence $p>0.05$ H_0 not rejected
		Municipality	47	12.40	2.16				
		Panchayat	100	12.05	2.76				
	Income	below 20000	40	11.88	2.31	0.264	0.901	Insignificant	Hence $p>0.05$ H_0 not rejected
		20000-30000	70	12.00	2.26				
		30000-40000	43	12.14	2.52				
		40000-50000	30	11.57	2.78				
		50000 above	132	11.98	2.54				
	Education	Undergraduate	37	11.57	2.70	0.479	0.751	Insignificant	Hence $p>0.05$ H_0 not rejected
		Graduate	85	12.04	2.32				
		PG	53	11.79	2.40				
		Diploma	16	12.44	1.75				
		Professional qualification	124	12.02	2.59				
	Occupation	Government Employee	111	11.72	2.34	1.319	0.268	Insignificant	Hence $p>0.05$ H_0 not rejected
		Business	60	12.20	2.08				
		Private employee	59	11.66	2.84				
		Profession	85	12.28	2.57				
	Age	20-30	6	12.50	2.43	0.277	0.842	Insignificant	Hence $p>0.05$ H_0 not rejected
		31-40	33	12.21	2.53				
		41-50	53	12.00	2.47				
		50 above	223	11.89	2.46				
	District	TVM	78	12.00	2.17	3.473	0.016	Significant	Hence $P<0.05$ H_0 rejected
		EKM	100	12.51	2.22				
		TCR	105	11.62	2.57				
		MPM	32	11.19	3.12				

The result of testing the above hypothesis at 5 per cent level shows that there is significant difference in RPB with districts in which the consumers live. However, no significant difference is noticed in gender, area, educational qualification, occupation and age. District- wise classification shows that RPB is high in Ernakulam district (μ=12.51) and low in Malappuram district (μ=11.19).

Since the ANOVA test indicates that significant difference exists among districts of consumer for RPB, the researcher conducted post hoc test or multiple comparison test to identify which district differs significantly and the result is exhibited in Table 6.48.

Table No: 6.49

Multiple Comparison test-RPB with District

Dependent Variable	Independent Variable		i-j	Sig
RI	EKM	TCR	.89095	0.009
	EKM	MLPM	1.32250	0.008

Table 6.49 shows that significant difference exists between the districts EKM and TCR, EKM and MLPM.

6.41 Recommendation (RMN) /Positive word of Mouth (PWOM)/ Altruism

PWOM/Altruism can be recognized /identified as a significant driver /most credible way of information transmission from an existing customer to potential customers. PWOM here refers to the likelihood of respondents by which they will recommend the product or service to a friend (Maxham, 1999). Therefore, it is quite natural to think that satisfied customer of SPV will definitely spread PWOM as it is an innovative sustainable renewable solution for power crisis.

H_1: There is a significant difference between socio demographic variables with respect to PWOM of RTPV consumers.

Table No. 6.50

Impact of Socio Demographics on Positive word of Mouth (PWOM)

Dependent Variable: RMN/PWOM	Independent Variable		N	Mean	SD	F	p	Decision	Discussion
	Gender	Male	281	11.18	3.24	1.087	.338	Insignificant	Hence p>0.05 H_0 not rejected
		Female	34	10.34	3.72				
	Area	Corporation	168	11.58	3.11	6.832	.001	Significant	Hence P<0.05 H_0 rejected
		Municipality	47	11.47	3.20				
		Panchayat	100	10.09	3.47				
	Income	Below 20000	40	6.102	1.39	353.61	0.000	Significant	Hence P<0.05 H_0 rejected
		20000-30000	70	8.283	1.33				
		30000-40000	43	9.976	1.52				
		40000-50000	30	12.40	1.10				
		50000 above	132	14.07	1.45				
	Education	Undergraduate	37	8.23	2.84	18.575	0.000	Significant	Hence P<0.05 H_0 Rejected
		Graduate	85	10.12	3.11				
		PG	53	11.69	3.10				
		Diploma	16	9.87	3.18				
		Professional qualification	124	12.52	2.84				
	Occupation	Government Employee	111	11.36	3.12	9.306	0.000	Significant	Hence P<0.05 H_0 Rejected
		Business	60	10.07	3.27				
		Private employee	59	9.86	3.19				
		Profession	85	12.48	2.81				
	Age	20-30	6	11.25	1.71	1.82	.144	Insignificant	Hence p>0.05 H_0 not rejected
		31-40	33	10.89	3.49				
		41-50	53	12.06	3.14				
		50 above	223	10.90	3.30				
	District	TVM	78	71.78	3.30	1.912	.128	Insignificant	Hence p>0.05 H_0 not rejected
		EKM	100	10.85	3.25				
		TCR	105	10.69	3.47				
		MPM	32	11.41	3.36				

The result of inferential statistics at 5 per cent level shows that there is significant difference in PWOM with, Area (F=6.832, P=.001), Income (F=353.610, p=.000), Education (F=18.575, p=.000) Occupation (F=9.306, p=.000). However no

significant difference can be seen in Gender and District. Further, multiple comparison test was done to identify which of these groups differs significantly and the result is exhibited in the following Table 6.51, 6.52, 6.53 and 6.54.

Table No: 6.51
Multiple Comparison test-PWOM with Area

Dependent Variable	Independent Variable		i-j	Sig
PWOM	Corporation	Panchayat	1.48805*	.000
	Municipality	Panchayat	1.38548*	.000

Table 6.51 shows that significant difference exists between and Panchayat area with Corporation and Municipality.

Table No: 6.52
Multiple Comparison test-PWOM with Income

Dependent Variable	Independent Variable		i-j	Sig
PWOM	Below Rs.20,000	Rs.20,000- Rs.30,000	2.18102*	.000
	Below Rs.20,000	Rs.30,000 – Rs.40,000	3.87363*	.000
	Below Rs.20,000	Rs.40,000 – Rs.50,000	.33997	.000
	Below Rs.20,000	Rs.50,000 above	.25515	.000
	Rs.20,000 – Rs.30,000	Rs.30,000 – Rs.40,000	- 1.69261	.000
	Rs.20,000 – Rs.30,000	Rs.40,000 – Rs.50,000	- 4.11642	.000
	Rs.20,000 – Rs.30,000	Rs.50,000 above	- 5.78460	.000
	Rs.30,000 – Rs.40,000	Rs.40,000 – Rs.50,000	-2.42381	.000
	Rs.30,000 – Rs.40,000	Rs.50,000 above	-4.09199	.000
	Rs.40,000 – Rs.50,000	Rs.50,000 above	-1.66818	.000

Table 6.52 shows that a significant difference exists between the monthly income group of' below Rs.20000' with the income group of Rs.'30000- Rs.40000', 'Rs. 40000-Rs. 50000'and Rs.50000 above. Further, there is a significant difference in income group of 'Rs.20000-Rs.30000'with 'Rs.30000-Rs.40000', 'Rs.40000-Rs.50000' and 'Rs.50000 above' income groups. Moreover, a significant difference is also found for the income group of 'Rs.30000-Rs.40000' with monthly income group of 'Rs.40000-Rs.50000' and Rs.50000 above' income group. Further, a

significant difference for 'Rs.40000-Rs.50000'income group with Rs.50000 above' income group is noticed.

Table No: 6.53

Multiple Comparison test-PWOM with Education

Dependent Variable	Independent Variable		i-j	Sig
PWOM	Undergraduate	Graduate	-1.89048*	.000
	Undergraduate	Post Graduate	-3.46374*	.000
	Undergraduate	Professional	-4.29175	.000
	Graduate	Post Graduate	-1.57326*	.000
	Graduate	Professional Qualification	-2.40128*	.000
	Diploma	Professional Qualification	-.82802	.000

Table 6.53 shows that a significant difference exists between undergraduates group with post graduates, PG and professionals. Further, it is also found that graduate group significantly differs with PG, and professional group. Moreover a significant difference is found in diploma group with professional group.

Table No: 6.54

Multiple Comparison test-PWOM with Occupation

Dependent Variable	Independent Variable		i-j	Sig
PWOM	Government Employee	Private Employee	1.49800*	.000
	Business	Profession	-2.40785	.000
	Profession	Private Employees	2.62478	.000

Multiple Comparison test-PWOM with Occupation shows that a significant difference is found between 'government employees and private employee', 'business and profession' and 'profession and private employees'.

Section 5

6.42 Barriers in the Kerala RTPV market: A Dealer Perspective

Even though it is claimed that SPV is a mature technology in India, and it is in a growing stage, there are still barriers for its penetration. Despite its average global cost reduction of 59 per cent for generating electricity from solar panels by 2025 (IRENA, 2016), the affordability of this innovative energy system in all segments still remains a question. The barriers may be varying across high and low income economies, among states and even regions. Here the common barriers for solar energy penetration are:-

1) Economic
2) Technical support
3) Lack of material quality and standardization
4) Government rules.
5) Lack of Consumer Education

Researchers who studied the barriers worldwide summarized it into four dimensions, viz. socio-technical, management, economic and policy. Dealers play an important intermediary role between the company and the customer in promoting the product, thereby contributing towards company's growth**.** (Table no: 1.9)**.** It was already revealed that three fourth of the SPV installations in the 10000 solar programme was done by TATA. Further, a majority of the MNRE dealers or companies are concentrated in central region especially Ernakulam district (Table no: 1.8) There is no comprehensive study on the barriers of RTPV adoption in Kerala. Furthermore, here, the barriers are analysed from the point of view of dealers. Therefore in this chapter, an investigation was made to study the barriers faced by the dealers while marketing RTPV system in Kerala market. From literature review, the researcher identified the various challenges in the RET market and was interested in knowing to what extent these barriers existed in Kerala. The scope of barriers is limited only to non-technical.

6.42.1 Spread of RTPV Dealers across Urban and Rural Areas

As the consumers' population is widely dispersed all across Kerala, the equal distribution of dealers will help in delivering products and services which is a challenging task for the marketers. Therefore it is imperative to analyze the presence of the RTPV dealers across the urban and rural areas of Kerala. The area-wise distribution of RTPV dealers in Kerala is depicted in Table 6.54.

Table No. 6.55

RTPV Dealers Spread across Urban and Rural Areas

Sl.No	Area	RTPV Dealers	Per cent
1	Urban	21	91.3
2	Rural	2	8.7
	Total	23	100

Source: Survey data

As can be seen from the above Table 6.55, more than 90 per cent of the RTPV dealers were in urban areas and only 8.7 per cent were from rural areas. Even though there is a high trend of urbanization, a high proportion of the potential consumers may be living in rural areas. The possible reason for low representation of rural area may be attributed to low level of infrastructure and also due to challenges in creating a marketing channel.

6.42.2 Year of Experience in Solar Energy Sector Market in Kerala

Indian or foreign companies market their products through the dealers who are situated all over Kerala. Here in this section, they are asked about their experience in this field. The consumers may look for the year of experience of company in a particular field, especially when it is an innovative technological product. Year of experience may be proved as one of the influencing factors for selecting company from consumer survey. It can inculcate a confidence in the mind of the consumers and they may perceive product or service features, reliability, customer care and every aspect of offering from the company. Therefore, it is important to note the experience of dealers also in this particular field.

Table No. 6.56
Year of Experience

SL. No:	Year of Experience	RTPV dealers	Per cent
1	1 to 3 years	5	21.7
2	4 to 6 years	7	30.4
3	7 to 9 years	1	4.34
4	10 or more	10	43.5
	Total	23	100

Source: Survey data

It can be observed from Table 6.56 that 43.5 per cent companies have an experience of 10 years or more following 4-9 years of experience comprising of 34.7 per cent and 1-3 years of experience comprising of 21 per cent. Therefore it can be inferred that 78.8 per cent of companies have an existence with more than 4 years of experience.

6.42.3 Nature of Dealers

ANERT played an institutional role which facilitates the market of RTPV by the introduction of '10000 solar rooftop programme'. The intervention of government will inculcate more confidence in the consumers about an innovative technology. Almost 30 Kerala-based companies are registered as MNRE channel partners. However, the ANERT selected some Non-Kerala companies for the implementation of this programme. Those companies are doing their business through dealers. Though these companies are already included in MNRE list, the dealers may not be involved in the list. So, here, the researcher asked about their nature about whether they are included in MNRE accredited channel partner or in the list ANERT dealers. In the Kerala market, there is another category of solar energy dealers who are doing business without government intervention and that category is not included in this study.

Table No. 6.57
Nature of Dealers

Sl.No:	Nature of Units	RTPV Dealers	Per cent
1	Dealers included in MNRE &	11	48
2	Dealers included in MNRE	12	52
	Total	23	100

Source: Survey data

It should be noted that there is almost an equal distribution of both types of dealers in Government- intervened market. More than 50 per cent of the RTPV dealers were included in MNRE channel partnership. It should be noted that private market should not be taken up for the study.

6.42.4 Type of dealers based on functions

There are several types of RTPV dealers as per the type of activities, viz. system integrators who are only doing assembling components of RTPV and its implementation. Some of the companies manufacture system components, like inverter. There may be small scale dealers to large scale project developers. This table exhibits the type of RTPV dealers in Kerala.

Table No. 6.58

Type of Dealer based on functions

Sl.No:	Dealer Type	RTPV	Per cent
1	System Integrators	12	52.2
2	Sub- Contracting Base+ System	4	17.4
3	Component manufacturer+ system	7	30.4
	Total	23	100

Source: Survey data

More than half of the RTPV dealers are mainly engaged with the function of system integration. 30 per cent are doing manufacturing of components of system like batteries, inverter etc. And only 4 per cent were engaged in subcontracting as well as system integrators.

6.42.5 Type of Solar Energy Products deals by RTPV dealers in Kerala

There are different types of solar energy products in the Kerala Market. However only two major products are taken into consideration. SPV from solar photovoltaic and SWH from solar thermal technology are the most familiar products in Kerala market.

Table No. 6.59

Type of Solar Energy Products deals by RTPV dealers in Kerala

Sl.No:	Solar Energy Products	RTPV	Per cent
1	SPV	9	39.1
2	SPV and SWH	14	60.9
	Total	23	100

Source: Survey data

As could be seen from the above table, more than half (60.9 per cent) of the RTPV dealers are dealing with both SPV and SWH products and 39 per cent deal in only SPV.

6.42.6 Type of RTPV

This application may be of mainly two types: Off Grid PV equipped with batteries for storage of energy which generated during day time and has no interaction with grid and on-grid PV connected to the grid for exporting the excess power produced by the consumer and can import the power if they need.

Table No. 6.60

Type of RTPV

SL.No:	RTPV Type	Frequency	Per cent
1	Off-Grid	1	4.3
2	On-Grid	4	17.4
3	Both	18	78.3
	Total	23	100

Table 6.60 discloses that more than three fourth (78 per cent) of the RTPV dealers in Kerala run on both off-grid and on-grid technology while 4.3 per cent run on off grid only and 17.4 per cent manage with on grid .

6.42.7 Type of PV technology used by the companies in Kerala

The components of RTPV system include solar panel + Inverter + battery + Control Components + Mounting frame. Solar panel array consists of module in

which cells are the basic components. Cell is a device that is used to generate electricity and converts solar energy to electrical energy. Number of solar cells are connected together to form a solar panel. Here solar cell converts solar energy into electrical energy, so it's referred to as photovoltaic cell. Photo stands for light and voltaic stands for electric energy. Conductors are the materials that allow current to flow through them. These cell technology determines the efficiency to generate electricity from sunlight. 'Photovoltaic Solar cells' are manufactured from special semi conductor materials. These materials use the energy of the photons from solar radiation striking the cell to produce an electric current. The photovoltaic effects result in electrons being separated from individual atoms. When these photons strike the cell materials the flow of these free electrons through the material will generate a voltage of approximately 0.5 volts. Virtually all of today's solar cells are made from slices of silicon, which is a semi conductor and use of the most common chemical elements on Earth, found in sand. PV Panels are made with these semi conductors. Currently, there are three types of technology existing in Kerala Market, namely. Poly Crystalline, Mono Crystalline, Thin Film. In this section, the aim is to identify and understand which technology is more used in Kerala market.

Table No. 6.61

Type of PV technology used by the companies in Kerala

SL.No:	Technology	RTPV Dealers	Per cent
1	Poly –Crystalline	17	73.9
2	Mono- Crystalline	2	8.7
3	Thin Film	4	17.4
	Total	23	100

More than three fourth (73.9) of the RTPV dealers choose poly crystalline technology in their solar panels. Mono Crystalline is more efficient in solar electricity generation. Further, it is costly too. May be because of that reason, majority of SPV installation done with poly Crystalline.

6.42.8 Area of operation

This section will provide information on dealers area of operations, whether they are operating region-wise, all over Kerala, national level and International.

Table No. 6.62

Area of operation of RTPV Dealers in Kerala

SL.No:	Area of operation	RTPV Dealers	Per cent
1	Regional level (Kerala)	6	26.1
2	All over Kerala	15	65.2
3	National	11	47.8
4	International	4	17.4
	Total	23	100

A majority of the dealers have operational activities spread across Kerala

6.42.9 Cumulative PV Installations of RTPV Dealers in Kerala

In this section, dealers are asked about their cumulative SPV installations which are classified into four categories**.**

Table No. 6.63

Cumulative PV Installations of RTPV Dealers in Kerala

Sl.No:	Installation (KW)	Number of Respondents	Per cent
1	< 100 KW	11	47.8
2	100-500 KW	4	17.39
3	500-1000KW	2	8.6
4	>1000 KW	6	26.08
	Total	23	100

A majority of the dealers have cumulative installations less than 100 KW.

6.42.10 Promotional Tools used by RTPV Dealers

There are several promotional tools used by the RTPV dealers in Kerala for the purpose of communication with the consumers. These promotional tools would play a vital role in influencing purchase decision. Therefore it is relevant to know the media employed by the RTPV dealers in Kerala.

Table No. 6.64
Promotional Tools used by RTPV Dealers in Kerala

Sl. No :	Types of Promotional Efforts	Frequency	Per cent
1	Advertisement in Press	13	56.5
2	Advertisement in Media	17	73.9
3	Through Internet	9	39.1
4	Through Exhibition	12	52.2
5	Any other Forms	3	13
6	None of the above	6	26.1

More than three fourth of the sample RTPV dealers in Kerala used advertisements in media followed by advertisement in press, exhibition and internet. It should be noted that 26 per cent used with nothing as their promotional tools. Other forms include awareness campaigns and direct mails. Interestingly, friends and relatives are an effective medium which is proved in the consumer survey. The importance of peer influence and PWOM should be recognized by the dealers and companies.

6.42.11 Cost of components

Currently 85 to 90 per cent of solar modules used in making panels in India, are imported from China and Malaysia. Flourishing of the domestic solar industry is the only way to make this technology affordable. If import duty rises, it will spur domestic manufactures. 'Directorate General of Trade Remedies' impose 25 per cent as safeguard duty**.**

Table No. 6.65
Cost of components and Labor

Sl. No:	Components	Average % of cost
1	Indian made components	56.35
2	Imported Components	44.17
3	Labour	15.14

More than half (56.35 per cent) of the components are Indian made. It should be noted that 44.17 per cent of the components are imported and labour constitutes 15.14

6.42.12 Support from Banks

Even though Government of India formulated policy drive initiatives for scaling up solar projects, obviously banks are the first and foremost choice for funding. Government of India introduced many start up schemes for encouraging sustainable ventures. In this section, dealers are asked whether or not they are receiving any support from banks.

Table No. 6.66

Support from Banks

Sl. No:	Support From Banks	Frequency	Percent
1	Yes	3	13.0
2	No	20	87
	Total	23	100

More than three fourth (87 per cent) of the RTPV dealers are not getting any support from banks. Self funding or boot strapping are always not enough for meeting both working capital and fixed capital needs. The dealers must opt for other funding options in order to widen the market.

6.42.13 Government Incentives in the SPV market

Direct capital subsidy, Renewable Portfolio Standard (RPS), and Solar set aside RPS target. Tax credits, Tax benefits, net metering, Net billing and Sustainable building requirements- are different types of Support Mechanisms introduced by Government of India (GoI) for promoting solar energy market. In this section an attempt was made to investigate the dealer preferences towards the incentive for different segments. Table 6.66 and Table 6.67 will provide information regarding dealers perceptions towards incentives and policies for boosting RTPV market.

Table No. 6.67

Type of support from Government from the point of view of Dealers

SL. No:	Types of Support	Frequency	Per cent
1	Incentive to the Component Supplier/Manufacturer	4	17.4
2	Incentive to the buyers	10	43.5
3	Incentive to the system Integraters	8	34.8
	None of them	5	21.7

43.5 per cent reported that incentives to buyers will promote this market while it should be noted that 21.7 per cent reported the rejection of the types of incentives.

Table No. 6.68

Suggestions to Government by RTPV Dealers in Kerala

Sl.No:	Suggestions	Frequency	Per cent
1	Export duty exemption from manufacturers	4	17.4
2	Customs duty exemption to importers	7	30.4
3	Remove service tax for solar installation	11	47.8
4	Remove VAT and CST for solar products	8	34.8
5	Provide subsidized loans to install SPV systems	3	13.0
6	Any other	4	17.4

Removal of service tax for solar installation was the suggestion by a majority of sample RTPV dealers in Kerala following VAT and CST removal.

6.42.14 Annual Maintenance Contract

AMC means the maintenance and service provided by the company through their service providers to the customer. As RTPV is a complex technological product, periodical maintenance is important for keeping its efficient working. Also systematic and timely AMC service is necessary for better performance and durability of RTPV. Timely maintenance like filling water in the batteries, proper cleaning of panels can save the SPV from poor performance. Therefore it seems to be highly relevant to know about whether AMC is provided by the company and about the timely service. Table 6.69 and Table 6.70 exhibit the information regarding the presence of AMC provision and their time period

Table No. 6.69

AMC

Sl. No:	AMC	Frequency	Percent
1	Have Provision of AMC	18	78.3
2	No Provision of AMC	5	21.7
	Total	23	100

More than three fourth (78.3 per cent) of RTPV dealers are giving AMC. It should be noted that the dealers interviewed were included in the '10000 solar programme' of Government. In that programme, already five year warranty for all components are ensured by the company. The importance of AMC will come after the warranty period for those consumers who adopted RTPV through this programme. It is noteworthy that almost 22 per cent of the dealers are not providing AMC service.

Table No. 6.70

Average Number of Visits to Customers for AMC

Sl. No:	Average Number of Customer visits by dealers	Frequency	Per cent
1	1-3 times	18	78.26
2	4-6 times	4	17.39
3	10 or more	1	4.35
	Total	23	100

The Table 6.70 indicates that a majority of RTPV dealers in Kerala visit customers annually 1-3 times for AMC. The cleaning of panel and filling water in battery should be done every three months. Therefore 1-3 times visit is not enough for proper maintenance.

6.42.15 Strengths considered by the RTPV dealers in Kerala

In the case of the ranking questions, the researcher has adopted the weighted average techniques with values starting from the highest possible rank to the lowest and weight as the number of respondents. The weighted mean is calculated for each

category and ranks are assigned on the basis of the values of the weighted mean. Table 6.71 reveals the ranks assigned by the 23 RTPV dealers interviewed across Kerala.

Table No. 6.71

Strengths considered by the RTPV dealers in Kerala

Sl. No:	Option	Mean	Rank
1	Price	2.71	6
2	product quality	6.57	1
3	Market knowledge	4.45	4
4	Supply chain management	3.22	5
5	Networking	2.36	7
6	Credibility	5.14	2
7	After sales service	4.83	3

The result of the analysis regarding the strength of sample RTPV dealers in Kerala reveals that product quality is, followed by credibility, after sales service, market knowledge, supply chain management, price and net working. It should be noted that market knowledge comes in the fourth position. It can be observed that their weaknesses are net working, high cost and supply chain management. Market knowledge is essential for developing strategies and supply chain management is critical for business success and growth.

6.42.16 Consideration of Rural Area customers

Despite Government schemes and incentives, the penetration of solar energy technologies still concentrated among higher socio economic profile consumers. Countries like India where more than three fourth people lives in rural area and depends on agriculture, will have more potential not only for SPV but also for solar pumps and water heater. Enhancing solar energy adoption in rural communities will help in its faster commercialization.

Table No. 6.72

Consideration of Rural Area customers

Sl. No:	Consideration of rural area customers	Frequency	Per cent
1	Yes	17	77.3
2	No	5	22.7
	Total	22	100

More than three fourth (77.3 per cent) of the RTPV dealers consider rural area consumers, as their targeted market segment. However majority may be belongs to high socio economic group. Emphasize must be given to efficiency improvement with affordable prices in order to penetrate this technology in to all segments. If marketers focus all category of consumers, they should definitely consider the price sensitivity of rural consumers and educate them for reducing the perception of system complexity.

6.42.17 Provision for financial means to customers

Although government incentive schemes are existing in order to reduce the upfront cost of the system, cost remain a barrier for its successful penetration.

Table No. 6.73

Provision for financial means to customers

Sl. No:	Provision of financial means for customers	Frequency	Percent
1	Yes	1	4.8
2	No	20	95.2
	Total	21	100.0

95 per cent of the dealers have not implemented any financial assistance in the form of discounts in order to increase sales**.** Payment options like installment mode of payment, discounts etc.. would enhance the penetration of the particular market.

6.42.18 Preferable Scheme of Government for RTPV market

'Solar connect scheme' for on grid type SPV and 'solar smart for off-grid SPV' are other schemes introduced after 10000 'Solar Rooftop Programme'. Dealers are asked about their preference for on-grid and off-grid type.

Table No. 6.74

Preferable Scheme of Government for RTPV market

Sl. No:	Most beneficial scheme	Frequency	Percent
1	10000 rooftop programme	5	33.3
2	solar connect	10	66.7
	Total	15	100.0

67 per cent of the RTPV dealers preferred to the solar connect scheme for on-grid. This may be because of the fact that off-grid may require battery replacement after its life time. But it should be noted that on-grid doesn't work during power cut. Domestic consumers need electricity storage facility for night time use. Therefore , the popularization of hybrid which is a combination of both off-grid and on-grid is most suitable.

6.42.19 Customer Satisfaction from dealer perception

Here is an attempt is made to know the dealers opinion about their consumers satisfaction. In order to measure the same from the dealers point of view, a one sample t test was conducted and the results are shown below.

H_1: Customer Satisfaction towards RTPV from dealers perspective is significant.

Table No. 6.75

One sample t test regarding dealers perception on existing consumers Satisfaction towards RTPV

Variable	N	Mea	S D	t	p	Decision
Satisfaction of customers on Government Scheme	23	4.18	.50	11.063	.000	Reject H0- High

To test the above hypothesis, one sample t test was used and the result is exhibited in Table 6.75. From the table the p value is less than 0.05 which indicates that the test is significant. So it can be concluded that the level of customer satisfaction towards RTPV from dealers' perspective shows a significant result. Mean value indicates that the satisfaction level is above average.

6.42.20 Dealer Satisfaction towards 10000 rooftop programme

An attempt is made to analyse the satisfaction of dealers towards '10000 rooftop programme' by conducting one sample t test and the result is exhibited in Table No: 6.76.

H_1: Dealer satisfaction with government scheme (10000 solar rooftop Scheme) is significant.

Table No. 6.76

Satisfaction of RTPV dealers on 10000 Rooftop Programme

Variable	N	Mean	SD	t	p	Decision	Discussion
Satisfaction with Government	23	2.48	1.12	2.228	.036	Significant	Reject H_0 –Low

From the table the p value is less than 0.05 which indicates that the test is significant. So it can be concluded that the level of satisfaction of RTPV dealers on government scheme is significantly different from average. Mean value indicates that the satisfaction level is below average.

6.42.21 Barriers faced by the RTPV dealers in Kerala Solar Energy Market

There are several barriers which are considered important by the RTPV dealers in Kerala. Table 6.76 exhibits the importance of various factors considered by the RTPV dealers in Kerala Solar Energy Market. Researcher recognized 34 variables which were adopted from literature review. One sample t test was done to examine the importance of barriers faced by RTPV dealers in Kerala and it was

significant from average level. 23 dealers interviewed across Kerala and the following observations were revealed.

$H19_{(1)}$ to $_{(34)}$: The barriers faced by the RTPV dealers in Kerala are Significant.

Table No. 6.77

Normality

Variable	N	Mean	SD	K-S Z	p
Existing customers attitude towards	22	4.18	0.50	0.944	0.197
Satisfaction with Government	23	2.48	1.12	1.104	0.175
Barriers	23	122.57	20.17	0.717	0.682

Table No. 6.78
Importance of barriers faced by the RTPV dealers in Kerala Solar Energy Market

Sl. No:	Statement	N	Mean	SD	Rank	t	p	Decision	Discussion
1	Lack of Awareness of consumers	23	3.87	0.97	12	4.309	.000	Significant	Reject H_0-Strong
2	Lack of fund for Promotion	23	3.61	1.41	23	2.077	.050	Significant	Reject H_0-Strong
3	Complexity of the Product	22	3.00	1.11	31	0.000	1.000	Insignificant	Not rejected
4	Credibility of solar technology among public	22	3.59	1.05	24	2.630	.016	Significant	Reject H_0-Strong
5	Cheap products are flooded in the market	23	3.91	1.08	11	4.041	.001	Significant	Reject H_0-Strong
6	Unable to provide timely after sale service	22	2.77	1.45	33	-.738	.469	Insignificant	Not rejected
7	Inadequate workforce skill and Training	23	3.26	1.25	29	1.000	.328	Insignificant	Not rejected
8	Lack of clarity in standards	23	4.17	0.83	4	6.750	.000	Significant	Reject H_0-Strong
9	Inadequate implementation of Policies	23	4.39	0.99	3	6.753	.000	Significant	Reject H_0-Strong
10	Complexity of subsidy Administration	22	4.55	0.60	1	12.167	.000	Significant	Reject H_0-Strong
11	High initial cost of solar	23	4.17	0.98	5	5.721	.000	Significant	Reject H_0-Strong

12	difficulty in overcoming established energy systems	23	3.48	1.24	25	1.852	.077	Insignificant	Not rejected
13	Inadequate financing Options	22	4.09	0.75	7	6.821	.000	Significant	Reject H_0-Strong
14	Failure to account all costs and benefits	22	4.14	0.64	6	8.333	.000	Significant	Reject H_0-Strong
15	Lack of stakeholder /community participation	23	3.70	0.93	20	3.602	.002	Significant	Reject H_0-Strong
16	Misplaced incentives	22	3.86	1.21	14	3.356	.003	Significant	Reject H_0-Strong
17	Unscientific fiscal and regulatory policies	21	3.76	0.83	18	4.202	.000	Significant	Reject H_0-Strong
18	Lack of credibility of companies or dealers	22	3.32	1.21	28	1.233	.231	In Significant	Reject H_0-Strong
19	Difficulty due to inaccessibility of location	22	2.73	1.24	34	1.030	.315	Insignificant	Not rejected
20	Does not add value to Property	22	3.05	1.21	30	.176	.862	Insignificant	Not rejected
21	Not understanding the long term importance of solar energy	22	3.73	1.32	19	2.592	.017	Significant	Reject H_0-Strong
22	High payback period for customers	23	3.70	1.11	21	3.019	.006	Significant	Reject H_0-Strong
23	Inadequate installation and service	22	3.86	4.23	15	.957	.350	Insignificant	Reject H_0-Strong
24	Lack of familiarity with the technology among dealers	21	3.00	1.05	32	0.000	1.000	Insignificant	Not rejected
25	Trends in conventional electricity costs	23	3.43	1.12	26	1.860	.076	Insignificant	Not rejected
26	Lack of ensuring quality of components	22	3.68	1.04	22	3.071	.006	Significant	Reject H_0-Strong
27	Lack of communication within industry	22	3.36	1.14	27	1.502	.148	Insignificant	Not rejected

28	Inconsistent government Policy relating to PV	22	3.82	1.14	16	3.367	.003	Significant	Reject H_0-Strong
29	Mismatch between market capability and actual achievement	22	3.77	0.81	17	4.461	.000	Significant	Reject H_0-Strong
30	Lack of renewable energy investment climate vs real estate	22	3.95	0.90	10	4.983	.000	Significant	Reject H_0-Strong
31	Lack of consumer Education	23	4.04	0.88	8	5.700	.000	Significant	Reject H_0-Strong
32	Tardy implementation of government decisions	22	4.55	0.80	2	9.056	.000	Significant	Reject H_0-Strong
33	Lack of equitable net metering guidelines	22	4.00	1.27	9	3.686	.001	Significant	Reject H_0-Strong

The result of one sample t test regarding the barriers faced by the dealers in Kerala RTPV market reveals significant results for the following:

The results revealed that there was statistically significant difference from the average value found at $p<0.01$ and $p<0.05$ in Lack of Awareness of consumer ($t=4.309$, $p=.000$, $M=3.87$), Lack of fund for promotion ($t=2.077$, $p=.050$, $M=3.61$), Credibility of solar technology among public ($t=2.630$, $p=.0.16$, $M=3.59$), Cheap products are flooding in the market ($t=4.041$, $p=.001$, $M=3.91$), Lack of clarity in standards ($t=6.750$, $p=.000$, $M=4.17$), Inadequate implementation of policies ($t=6.753$, $p=.000$, $M=4.39$), Complexity of subsidy administration ($t=12.16$, $p=.000$, $M=4.55$), Inadequate financing option ($t=6.821$, $p=.000$, $M=4.09$), Failure to account all costs and benefits ($t=8.333$, $p=.000$, $M=4.14$), Lack of stakeholder and community participation ($t=3.602$, $p=.002$, $M=3.70$), Misplaced incentives ($t=3.356$, $p=.003$, $M=3.86$), Unscientific fiscal and regulatory policies ($t=4.202$, $p=.000$, $M=3.76$), Not understanding the long term importance of solar energy($t=2.592$, $p=.017$, $M=3.73$), High payback period for customers ($t=3.019$, $p=.006$, $M=3.70$), Lack of ensuring quality of components ($t=3.071$, $p=.006$, $M=3.68$), Inconsistent

government policies (t=3.367, p=.003, M=3.82), Mismatch between market capability and actual achievement (t=4.461, p=.000, M=3.95), Lack of renewable energy investment climate Vs real estate (t=4.983, p=.000, M=3.77), Lack of consumer education (t=5.700, p=.000, M=4.04), Tardy implementation of government decision (t=9.056, p=.000, M=4.55), Lack of equitable net metering and guidelines (t=3.686, p=.001, M=4.00), and lack of community involvement and support (t=4.534, p=.000, M=3.87). This indicates that these are strong barriers faced by RTPV dealers in Kerala. This can be grouped into four categories, namely policy and regulatory barriers, Financial and Economical, Socio Technical and Marketing.

Also the result indicates that 11 barriers proved to be insignificant, viz. complexity of the product, unable to provide after sale service, inadequate workforce skill, difficulty in overcoming established energy systems, lack of credibility of companies or dealers, difficulty due to inaccessibility, does not add value to property, inadequate installation and service, lack of familiarity with the technology among dealers, trends in conventional electricity costs and lack of communication within industry.

These findings are similar to (Lof, 1978) who specified two reasons for low penetration of solar energy in developing countries, viz. 1) its expensive nature and 2) poor understanding of needs in those areas. Even though, solar technology is moving forward, challenges like economy, efficiency and storage still exists. (Tapaninen, Seppanen & Makinen, 2009) conducted an empirical study on Barriers to the adoption of wood pellet heating technology, Finland By comparing Roger (1995). Diffusion of Innovation and Chritencent's frameworks, observed that price and Relative advantage were identified as significant barriers followed by functionality and compatibility, then convenience and complexity. (Ahlborg & Hammar, 2014) conducted an Empirical study about Drivers and Barriers of RETs in Mozambique & Tanzania Lack of access to human capital, little interest from private sector, are the major barriers and political ambitions and local actors played driving force for acceleration. (Foxon & Pearson, 2008) studied the low carbon technology innovation in the UK and the role of government and deployment of policies in the UK and found that Interaction with stakeholders and policy makers ensure their role and advancement of procedural and institutional basis.

The barrier types which are grouped into five factors are explained briefly below, namely Policy related, Marketing, Socio Technical, Physical, Economic and Financial.

6.42.22 Location wise difference with regard to customer satisfaction, dealer satisfaction and barriers

Independent sample t test and one way ANOVA were conducted to know if there is significant difference with regard to existing customers' attitude towards SPV products, dealers' satisfaction with the government scheme, and barriers among units from urban and rural area**.**

H1 $_{(1)}$ to $_{(3)}$: There is no significant difference with regard to Attitude, satisfaction and barriers among dealers from different location.

Table No. 6.79

Difference with regard to Attitude, Satisfaction and Barriers for Location of Units

Sl No	Independent Variable	Dependent Variable	N	M	SD	t	0	Decision	Discussion
1	Customer Satisfaction	Rural Urban	220	4.50 4.15	0.71 0.49	0.939	0.359	Insignificant	$H_{0(1)}$ not rejected
2	Dealer Satisfaction	Rural Urban	221	1.50 2.57	0.71 2.57	1.310	0.204	Insignificant	$H_{0(2)}$ not rejected
3	Barriers	Rural Urban	221	136.50 121.24	17.68 20.27	1.024	0.318	Insignificant	$H_{0(3)}$ not rejected

When analyzing the influence of location of units on existing customers' satisfaction towards RTPV, dealer satisfaction with government scheme and barriers in RTPV market, by using inferential statistics, it is found to have no statistically significant difference.

6.42.23 Difference regarding customer satisfaction, dealer satisfaction and barriers among nature of dealers

Independent sample t test and one way ANOVA were conducted to know if there is significant difference with regard to existing customers attitude towards SPV

products, dealers' satisfaction with the government scheme, and barriers among different types of dealers**.**

$H1_{(1)}$ to $_{(3)}$: There is significant difference with regard to Attitude, satisfaction and barriers among dealers of different nature.

Table No. 6.80

Difference with regard to Attitude, Satisfaction and Barriers with Nature of Company

Independent Variable	Dependent Variable	N	M	SD	t	p	Decision	Discussion
Customers satisfaction towards RTPV	ANERT/MNRE channel Partners	10	3.90	0.32	2.726	0.012	Significant	$H_{0(1)}$ rejected
	Dealer of MNRE company	12	4.42	0.51				
Dealers Satisfaction With Governme Scheme	ANERT/MNRE channel Partners	10	2.82	1.17	1.310	1.422	Insignific ant	$H_{0(2)}$ not rejected
	Dealer of MNRE company	12	2.17	1.03				
Barriers	ANERT/MNRE channel Partners	11	123.64	20.77	0.239	0.814	Insignific ant	$H_{0(3)}$ not rejected
	Dealer of MNRE company	12	121.58	20.48				

When analyzing the influence of nature of company or dealers on existing customers' attitude towards RTPV, satisfaction of dealers on government scheme and barriers to RTPV market by using inferential statistics found to have statistically significant difference in existing customers satisfaction towards the product (t=2.762, p=0.012). When analyzing the mean score, dealers of MNRE companies show a higher perception regarding the consumers' satisfaction regarding their product than dealers involved in both MNRE and ANERT. The possible reason for satisfaction of the dealers involved in ANERT may be more related with installations of 10000 solar programme. Above analysis (table 6.81) regarding their satisfaction toward

government scheme is below average. Therefore it can be inferred that dealers' perception of SPV through ANERT is not very satisfactory.

While there is no significant difference with respect to dealers satisfaction on government schemes and barriers.

6.42.24 Difference regarding customer satisfaction, dealer satisfaction and barriers with experience of dealers

Independent sample t test and one way ANOVA were conducted to know if there is significant difference with regard to customer satisfaction, dealer satisfaction and barriers with experience of dealers.

$H1_{(1)}$ to $_{(3)}$: There is significant difference with regard to Attitude, Satisfaction and Barriers among dealers of different Years of Experience.

Table No: 6.81

Difference with regard to Attitude, Satisfaction and Barriers for Years of Experience of Company

Independent Variable	Dependent Variable	N	M	SD	F	p	Decision
Customers Satisfaction towards RTPV	1-3 Years	4	4.00	0.00	2.51	0.091	Insignificant
	4-6 Years	7	4.57	0.53			
	7-9 Years	1	4.00				
	➢ 10	10	4.00	0.47			
Dealer Satisfaction With Government Scheme	1-3 Years	5	2.40	0.89	0.956	0.433	Insignificant
	4-6 Years	7	2.00	1.00			
	7-9 Year	1	2.00				
		10	2.90	1.29			
Barriers	1-3 Years	5	115.00	14.04	0.793	0.513	Insignificant
	4-6 Years	7	124.29	27.68			
	7-9 Years	1	101.00				
	>10	10	127.30	16.90			

When analyzing the influence of year of experience of dealers on existing customers' attitude towards RTPV (F=2.517, P=0.091), satisfaction of dealers with government scheme (F=0.956, P=0.433) and Barriers (F=0.793, P=0.513) in RTPV market by using inferential statistics found that there is no statistically significant difference .

Table No: 6.82

Test of Hypotheses

Sl.no	Hypothesis Testing	Statistical Test	Results
Objective 1- Pre Adoption Factors			
$H_0 17.A_{1)}$ to $_{(11)}$	Awareness level of consumers Regarding various solar products is significant in Kerala.	One sample t test	All the items found to be significant except $H_0 1_{(6)}$ and$_{(7)}$. Hence $H_0 1$ rejected
$H_0 17.B_{1)}$ to $_{(20)}$	Awareness level of users Regarding RTPV is Significant in Kerala.	One sample t test	All the items has significant difference from average value except $H_0 1_{(15),16,18}$ and$_{(19)}$. Hence $H_0 1$ rejected
$H_0 17.C_{1)}$ to $_{(7)}$	Testing of $H3_{(1)}$ to $H3_{(7)}$: RTPV users perception level towards the effectiveness of different media for getting awareness about solar energy products is significant in Kerala.	One sample t test	All the items found to be significant. Hence $H_0 3$ Rejected
$H_0 17.D_{1)}$ to $_{(11)}$	Various factors determining the Choice of suppliers for RTPV Adoption by domestic users in Kerala are significant	One sample t test	All the items found to be significant except $H_0 5_{(6),(7)}$. Hence $H_0 3$ rejected
$H_0 17.E_{1)}$ to $_{(10)}$	Various items regarding Economic factors while Adopting RTPV perceived by the consumers in Kerala are Significant	One sample t test	All the items found to be significant. Hence $H_0 6$ Rejected
$H_0 17.F_{(1)}$ to $_{(7)}$	The effectiveness of various factors contributing to attitude towards the government initiatives for SPV Penetration in Kerala is significant	One sample t test	All the items found to be significant. Hence $H_0 6$ Rejected
$H_0 17.G_{(1)}$ to $_{(6)}$	The effectiveness of various factors determining perceived usefulness of RTPV by residential users while Adoption is significant in Kerala	One sample t test	All the items found to be significant. Hence $H_0 8$ Rejected
$H_0 17.H_{(1)}$ to (11):	Various factors determining EA/RA of RTPV by residential users while adoption are significant in Kerala	One sample t test	All the items found to be significant. Hence $H_0 9$ Rejected
$H_0 17.I_{(1)}$ to $_{(11)}$:	The concern for factors related to BSR among Kerala RTPV residential users Is significant.	One sample t test	All the items found to be significant. Hence $H_0 10$ rejected

$H_0$17.$J_{(1)}$ to (4)	The concern for the determinants towards subjective norms among Kerala domestic SPV users is Significant	One sample t test	All the items found to be significant except H_{01}. Hence $H_0$10 rejected
$H_0$17.$K_{(1)}$ to (7):	Pre adoption factors for RTPV Exhibited the Kerala residential Consumers is significant	One sample t test	All the items found to be significant. Hence $H_0$11 rejected
Post Adoption Factors			
$H_0$18.$A_{(1)}$ to (6):	The satisfaction level regarding Product Oriented Aspects among RTPV residential users in Kerala is significant	One sample t test	All the items found to be significant. Hence $H_0$12 rejected
$H_0$18.$B_{(1)}$ to (2):	The satisfaction level towards the Price charged by company among RTPV residential users in Kerala is significant	One sample t test	All the items found to be significant. Hence $H_0$13 rejected
$H_0$18.$C_{(1)}$ to (4)	The satisfaction level towards EOU with the system among Kerala RTPV residential users is significant	One sample t test	All the items found to be significant except $H_{0(2)}$. Hence $H_0$14 rejected
$H_0$3.$D_{(1)}$ to (9)	The satisfaction level towards SOA of RTPV suppliers among Kerala residential users is significant	One sample t test	All the items found to be significant. Hence $H_0$15 rejected
$H_0$18.$F_{(1)}$ to (4)	The satisfaction level regarding the communication aspects of RTPV among residential users in Kerala users is significant	One sample t test	All the items found to be significant. Hence $H_0$16 rejected
$H_0$18.$G_{(1)}$ to (3):	The satisfaction level regarding the convenience aspects about RTPV among residential users in Kerala users is significant	One sample t test	All the items found to be significant. Hence $H_0$17 rejected
$H_0$18.$H_{(1)}$ to (6):	The level of satisfaction regarding different attributes towards RTPV among users in Kerala is significant	One sample t test	All the items found to be significant. Hence $H_0$17 rejected
Socio Demographic Differences – Pre Adoption Factors			
AWA H_0	There is no statistically significant difference with respect to awareness regarding different types of solar energy products with gender	Independent sample t test	Rejected
H_0	There is on statistically significant difference with respect to awareness regarding different types of solar energy products with Area.	One way ANOVA	Not Rejected

H_0	There is no statistically significant difference with respect to awareness regarding different types of solar energy products with Income.	One way ANOVA	Rejected
H_0	There is no statistically significant Difference with respect to awareness regarding different types of solar energy products with Education.	One way ANOVA	Rejected
H_0	There is no statistically significant difference with respect to awareness regarding different types of solar energy products with Occupation.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to awareness regarding different types of solar energy products with Age.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to awareness regarding different types of solar energy products with District.	One way ANOVA	Not Rejected
MEDIA H_0	There is no significant difference with respect to effectiveness towards alternative sources of information with Gender.	Independe nt sample t test	Not Rejected
H_0	There is no significant difference with respect to effectiveness towards alternative sources of information with Area.	One way ANOVA	Not Rejected
H_0	There is no significant difference with respect to effectiveness towards alternative sources Of information with Income.	One way ANOVA	Not Rejected
H_0	There is no significant difference with respect to effectiveness towards alternative sources Of information with Educational.	One way ANOVA	Rejected
H_0	There is no significant difference with respect to effectiveness towards alternative sources of information with Occupation.	One way ANOVA	Not Rejected
H_0	There is no significant difference with respect to effectiveness towards alternative sources of	One way ANOVA	Not Rejected

	information with Age.		
H_0	There is no significant difference with respect to effectiveness towards alternative sources of information with District.	One way ANOVA	Not Rejected
Selection of company H_0	There is no significant difference with respect to factors affecting selection of company for RTPV installation with Demographic Variables.	Independent sample t test & One way ANOVA	Not Rejected
AWA H_0	There is no statistically significant difference with respect to awareness regarding RTPV with Gender.	Independent sample t test	Rejected
H_0	There is no statistically significant difference with respect to awareness regarding RTPV with Area.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to awareness regarding RTPV with Income.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to awareness regarding RTPV with Education.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to awareness regarding RTPV with Occupation.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to awareness regarding RTPV with Age.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to awareness regarding RTPV with District.	One way ANOVA	Not Rejected
EF H_0	There is no statistically significant difference with respect to economic factors regarding RTPV with Gender.	Independent sample t test	Not Rejected
H_0	There is no statistically significant difference with respect to economic factors regarding RTPV with Area.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to	One way ANOVA	Rejected

	economic factors regarding RTPV with Income.		
H_0	There is no statistically significant difference with respect to economic factors regarding RTPV with Education.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to economic factors regarding RTPV with Occupation.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to economic factors regarding RTPV with Age.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to economic factors regarding RTPV with District.	One way ANOVA	Rejected
ATGI H_0	There is no statistically significant difference with respect to ATGI regarding RTPV with Gender.	Independent Sample t test	Not Rejected
H_0	There is no statistically significant difference with respect to ATGI regarding RTPV with Area.	One way ANOVA	Not Rejected
H_1	There is statistically significant difference with respect to ATGI regarding RTPV with Income.	One way ANOVA	Rejected
H_0	There is no statistically significant difference with respect to ATGI regarding RTPV with Education.	One way ANOVA	Rejected
H_0	There is no statistically significant difference with respect to ATGI regarding RTPV with Occupation.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to ATGI regarding RTPV with Age.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to ATGI regarding RTPV with District.	One way ANOVA	Not Rejected
PU H_0	There is no statistically significant difference with respect to PU regarding RTPV with Gender.	Independent Sample t test	Not Rejected
H_0	There is no statistically significant difference with respect to PU regarding RTPV with Area.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to PU	One way ANOVA	Not Rejected

	regarding RTPV with Income.		
H_0	There is no statistically significant difference with respect to PU regarding RTPV with Education.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to PU regarding RTPV with Occupation.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to PU regarding RTPV with Age.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to PU regarding RTPV with District.	One way ANOVA	Not Rejected
EA H_0	There is no statistically significant difference with respect to EA regarding RTPV with Gender.	Independent Sample t test	Not Rejected
H_0	There is no statistically significant difference with respect to EA regarding RTPV with Area.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to EA regarding RTPV with Income.	One way ANOVA	Rejected
H_0	There is no statistically significant difference with respect to EA regarding RTPV with Education.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to EA regarding RTPV with Occupation.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to EA regarding RTPV with Age.	One way ANOVA	Not Rejected
BSR H_0	There is no statistically significant difference with respect to BSR regarding RTPV with Gender.	Independent Sample t test	Not Rejected
H_0	There is no statistically significant difference with respect to BSR regarding RTPV with Area.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to BSR regarding RTPV with Income.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to BSR regarding RTPV with Education.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to BSR regarding RTPV with	One way ANOVA	Not Rejected

	Occupation.		
H_0	There is no statistically significant difference with respect to BSR regarding RTPV with Age.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to BSR regarding RTPV with District.	One way ANOVA	Not Rejected
SN H_0	There is no statistically significant difference with respect to SN regarding RTPV with Gender.	Independent Sample t test	Not Rejected
H_0	There is no statistically significant difference with respect to SN regarding RTPV with Area.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to SN regarding RTPV with Income.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to SN regarding RTPV with Education.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to SN regarding RTPV with Occupation.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to SN regarding RTPV with Age.	One way ANOVA	Not Rejected
H_0	There is no statistically significant difference with respect to SN regarding RTPV with district.	One way ANOVA	Rejected
Post Adoption Factors			
POA H_0	There is no significant difference between satisfaction regarding Quality with RTPV with respect to Demographic Variables.	Independent sample t test & One way ANOVA	Not Rejected
PRI H_0	There is no significant difference between satisfaction regarding price of RTPV with respect to Demographic Variables.	Independent sample t test & One way ANOVA	Not Rejected
COMN H_0	There is no significant difference between satisfaction regarding communication with Demographic Variables.	Independent sample t test & One way ANOVA	Not Rejected
CON H_0	There is no significant difference between satisfaction regarding convenience with respect to Demographic Variables.	Independent sample t test & One way ANOVA	Not Rejected

EOU H_0	There is no significance difference between satisfaction regarding EOU of RTPV with respect to Demographic Variables.	Independent sample t test & One way ANOVA	Not Rejected
SOA H_0	There is no significance difference between satisfaction regarding SOA dimensions with RTPV with respect to Demographic Variables.	Independent sample t test& One way ANOVA	Not Rejected
Outcome Variables			
RPB H_0	There is no significance difference between RPB with regard to Gender.	Independent sample t test &	Not Rejected
H_0	There is no significance difference between RPB with regard to Area.	One way ANOVA	Not Rejected
H_0	There is no significance difference between RPB with regard to Income.	One way ANOVA	Not Rejected
H_0	There is no significance difference between RPB with regard to Education.	One way ANOVA	Not Rejected
H_0	There is no significance difference between RPB with regard to Occupation.	One way ANOVA	Not Rejected
H_0	There is no significance difference between RPB with regard to Age.	One way ANOVA	Not Rejected
H_0	There is no significance difference between RPB with regard to District.	One way ANOVA	Rejected
PWOM H_0	There is no significance difference between PWOM with regard to Gender.	Independent sample t test	Not Rejected
H_0	There is no significance difference between PWOM with regard to Area.	One way ANOVA	Rejected
H_0	There is no significance difference between PWOM with regard to Income.	One way ANOVA	Rejected
H_0	There is no significance difference between PWOM with regard to Education.	One way ANOVA	Rejected
H_0	There is no significance difference between PWOM with regard to Occupation.	One way ANOVA	Rejected

H_0	There is no significance difference between PWOM with regard to Age.	One way ANOVA	Not Rejected
H_0	There is no significance difference between PWOM with regard to District.	One way ANOVA	Not Rejected
$H_{0\ (1)\ to\ 34)}$	The barriers faced by the RTPV dealers in Kerala market are notsignificant.	One sample t test	
H_0	There is no significant difference With regard to Attitude, satisfaction and barriers among dealers from different location.	Independent sample t test& One way ANOVA	Not Rejected
H_0	There is no significant difference With regard to Attitude, satisfaction and barriers among dealers of different nature.	Independent sample t test & One way ANOVA	Not Rejected
H_0	There is no significant difference With regard to Attitude, satisfaction and barriers among dealers of different nature.	Independent sample t test & One way ANOVA	Not Rejected
H_0	Satisfaction from existing customers towards RTPV from dealers perspective is not significant.	One sample t test	Rejected
H_0	Satisfaction of dealers towards 10000 solar Rooftop scheme is not significant.	One sample t test	Rejected

6.43 Conclusion

This chapter includes some additional findings from the analysis of RTPV consumers and barriers existing in the Kerala RTPV market from dealer's perspective. Other additional findings based on primary data analysis of sample RTPV consumers reveal that RTPV and SWH are the most familiar SPV products among Kerala RTPV consumers. The awareness regarding solar energy products is found to be significantly different with regard to gender, income and education. Gender wise classification reveals that the mean awareness regarding solar energy products male respondents is higher than females. Awareness regarding solar energy products of RTPV consumers who had monthly income of 'Below Rs.20000' category is significantly different from the RTPV consumers belong to other income group. Awareness regarding solar energy products of RTPV consumers having

professional educational qualification category is significantly different from the RTPV consumers having other qualifications.

When considering RTPV Sample consumers opinion, Traditional communication media like Print medias and Television are the most effective methods for getting awareness regarding solar energy products for consumers. This may be due to the fact that a majority of the consumers are above 50 years old even though they possess higher educational qualification, occupational status and income. The most important reason which influenced the consumers for selecting a company for RTPV adoption was found to be credibility of the company. It may be due to the solar scams reports which may inculcate a corrupted market image in the minds of the potential consumers.

The result of inferential statistics revealed that out of the seven antecedents (Pre adoption factors) to CAI, RTPV awareness, EF, EA, ATGI, and SN are found to be significantly different with socio demographic variables. Gender is found to be significant for RTPV awareness. Income and district are found to be significant for economic factors, Income and Education for ATGI, Income for Environmental factors, and district for Subjective Norms. However, there are no such differences among the antecedents of SAT. Similarly for RPB, there is significant difference in RTPV consumers belonging to different districts and for PWOM, there is significant difference found in area, income, education and occupation.

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CHAPTER 7

FINDINGS, CONCLUSIONS AND IMPLICATIONS

Chapter - 7

Findings, Conclusions and Implications

7.1 Summary

Rooftop Photovoltaic power plant is one of the useful products for generating renewable energy. It is a decentralized micro generation technology which can be adopted by both domestic and non domestic sector. Despite all government measures, the commercialization of this particular product has not reached all segments in the society. The government solar programme was run by MNRE at the national level and in Kerala, there is a state nodal agency called ANERT for government programme. ANERT acts as a facilitator in the penetration of RTPV in Kerala. Adoption of green energy is the need of today, in order to mitigate climate change and global warming issues. Drawing attention of consumers towards this particular product is a bit difficult because of its initial capital requirement. At the same time India is now ranked seventh in SPV installation. However, in Kerala, the penetration of this RTPV is still at a nascent stage. The low penetration level indicates that there exist obstacles for the commercialization of the product.'10000 rooftop solar programme' of ANERT was one of the best initiatives from the part of the Government of Kerala for RE propagation. After that programme, ANERT announced two more programmes for on-grid and off-grid solar again. The customer satisfaction is also an imperative part in this regard. The government is also looking forward to the feedback of this programme for announcing the next phases for solar energy propagation.

Statement of Problem

The status of Kerala has changed from power surplus state to power deficient state. Only 43 per cent of the power requirement is produced by the State Electricity Board and the balance is purchased from central power stations and private market at high rates. The power requirement of the state is on the increase, and the power generation from hydro sources which is the major source for Kerala is not enough due to environmental problems. The penetration of RTPV in Kerala market is necessary to provide a solution to energy deficiency. However the contribution of solar power is very negligible. The consumers become the power producers through RTPV; therefore it is highly relevant for our State, which happens to be the highest household

electricity consuming state among the Indian states. Even though Kerala is known for 100 per cent literacy, majority of the people are unaware of this technology. The knowledgeable people also suspect the reliability and credibility of this technology. Although high cost is recognized as the most prominent barrier to its slow penetration, people in Kerala responded favorably for the government initiated schemes. It is also noted that people have installed solar power plants even without subsidies. Their cost is not a hindering factor for those adopters. The growing trend for environmental protection also urged people for adopting this product. Being green is not the only factor behind RTPV adoption. Generally, companies face resistance from the side of the consumers, especially for an innovative technological product. So, an indepth understanding of the pre and post adoption behaviour of the consumers is important for furthering its penetration.

Objectives

1. To develop a model explaining the adoption behaviour of Rooftop Photovoltaic (RTPV) consumers in Kerala.
2. To study the influence of the factors which drive pre adoption behavior towards Rooftop Photovoltaic.
3. To study the influence of the factors which drive post adoption behavior towards Rooftop Photovoltaic.
4. To identify the barriers faced by Rooftop Photovoltaic dealers in Kerala.

Hypothesis

Objective 1:

H1. Product oriented aspects have a positive impact on satisfaction

H2. Price oriented aspects have a positive impact on satisfaction

H3. Communication has a positive impact on satisfaction

H4. Convenience aspects have a positive impact on satisfaction

H5. Service oriented aspects have a positive impact on satisfaction

H6. Ease of Use has a positive impact on satisfaction

H7. Satisfaction has a positive impact on continued adoption intention

H8. Awareness regarding RTPV has a positive impact on continued adoption intention

H9. Economic Factors have a positive impact on continued adoption intention

H10. Attitude towards Government Initiatives has a positive impact on adoption intention

H11. Environmental Attitude/ Relative Advantage has a positive impact on continued adoption intention

H12. Buyer's Social Responsibility has a positive impact on continued adoption intention

H13. Perceived Usefulness has a positive impact on continued adoption intention

H14. Subjective Norms has a positive impact on continued adoption intention

H15. Continued adoption intention has a positive impact on Repeated Purchase Behavior

H16. Continued adoption intention has a positive impact on Positive Word of Mouth

Objective 2:

H17: The involvement of pre adoption factors in actual RTPV adoption among consumers is significant in Kerala.

Objective 3:

H18: The satisfaction regarding RTPV system among consumers is significant in Kerala.

Objective 4:

H 19: The barriers faced by the RTPV dealers in Kerala is significant

H 20: Socio demographic variables can significantly impact adoption behaviour of RTPV consumers.

The research was focussed on concentrating on the antecedents and consequences of off-Grid RTPV adoption among residential consumers in Kerala and was evaluated using a new model with the identified variables from the review of existing literature**.** It also tried to identify the major barriers faced by the dealers with regard to RTPV in Kerala market. It took into account the beneficiaries of '10000

solar power plant programme' of ANERT (1KW domestic installation). Therefore it is considered as a subsidy driven market.

Methodological Design

This study is based on primary as well as secondary data from various published documents, such as magazines, research journals, ANERT annual reports, MNRE annual reports, research dissertations and theses, WISE report, Study Reports of TERI, World Bank, IRENA, IEA, and Economic Review of State Planning Board. Population includes household RTPV users and SPV companies/dealers in Kerala. Primary data has been collected from a total of 315 consumers from 10000 solar rooftop programme of ANERT in Kerala by using a structured pre tested questionnaire through direct visit and mail survey. A pilot study was conducted with 50 respondents for pre testing with the questionnaire in Thrissur and Eranakulam districts. Reliability and Normality of the questionnaire were also tested and the sample size was determined by using power analysis.

Sampling Design

Multi-stage random sampling is used for selecting the sample RTPV respondents. Primary data have been collected from the SPV consumers who have adopted 1KW system through '10000 solar roof top programme' of ANERT.

Sample Design for SPV Consumers

In the first stage, districts in Kerala were divided into two groups, such as high installation districts and low installation districts. In the second stage, four districts were randomly selected from higher installation districts. They were Thiruvananthapuram, Ernakulam, Thrissur and Malappuram. And in the third stage, the researcher randomly selected the respondents from the district- wise list of RTPV consumers from ANERT. A final sample of 315 was collected for the study.

The statistical analysis comprised three stages. In the first stage, the descriptive statistics of the measurement items was examined and the reliability and validity of the measure applied to this study was assessed. In the second stage, the proposed research model was tested and this involves assessing the contributions and significance of the manifest variables path coefficients. In the third stage, the

influence of pre and post adoption factors in actual RTPV adoption and also the impact of socio demographic difference on the same were examined. Further, the effect of pre adoption factors on CAI were also analysed. The data were analyzed through SPSS 20.0 for Windows. Descriptive statistics was used to describe and summarize the properties of the mass of data collected from the RTPV respondents. (Parametric statistics like one way ANOVA and t-test were used for comparison of the factors with demographic variables. A level of 0.05 was established a priori for determining statistical significance.)

Outline of Chapters

The report of the work has been presented in 7 chapters.

Chapter 1 - The first chapter consists of introduction, significance of the study, research problem, scope, objectives, hypothesis, methodological design, conceptual model, limitations and chapterisation of the study.

Chapter 2 - The second chapter constitutes the review of existing literature. It is divided into five sections, namely literature related to green energy, solar energy, antecedents/pre adoption of APB for RTPV, post adoption behaviour for RTPV including antecedents (six dimensions contributing to SAT) and consequences of satisfaction (CAI, RPB and PWOM).

Chapter 3 - The third chapter presents an overview. This chapter is divided into three sections which consist of Green energy scenario, Global and National solar energy scenario, national and Kerala solar energy scenario.

Chapter 4 - The fourth chapter includes the theoretical background for model constructs. It consists of pre and post adoption factors for RTPV adoption.

Chapter 5 - Chapter five presents the research model analysis. This chapter is divided into 4 sections. Section A deals with the descriptive statistics related to demographic profiles and descriptive statistics of psychographic aspects of the sample RTPV consumers. Section B covers the EFA of all the constructs involved in the model, section C includes the CFA of the model constructs and section D consists of research model analysis through testing of hypotheses.

Chapter 6 – The sixth chapter presents the effects of pre and post adoption drives on actual RTPV adoption, the results of analysis of demographic comparison with pre and post adoption factors and the analysis of the barriers faced by RTPV dealers in Kerala market.

Chapter 7- Seventh and last chapter presents the major findings of the study, the conclusion, suggestions and scope for further research.

7.2 Findings

7.2.1 Overview of Green Energy Scenario

Even though India stood in the fourth position in Energy related Carbon Emissions per year from burning Fossil Fuels, it should also be remembered that the per capita CO2 emission is low in India**.** Still we have to control this as a part of INDC and at the same time ensure a sustainable development. In terms of RE Capacity, India comes in the fourth position with 4.58 per cent share. Indian RE investment trends are high in both AGR and CAGR and it shows a positive indication. AGR of RE of India is higher than the global average growth. A high increase can be observed in both charts in 2010-11 which can be attributed to policy initiatives, viz., the UNFCCC agreement globally and JNNSM in India.

When considering top 10 investing countries in Renewable Power**,** it can be observed that developing countries are coming forward in RE investment instead of developed countries and India stands in the fifth position in global level RE investment. Its also noted that there is a deficiency trend in the availability of power. However, it is also noteworthy that the deficiency is in a decreasing trend. AGR and CAGR of Peak time demand is higher than the total power requirement. Share of RE in India's installed electricity capacity shows the highest growth rate while comparing with other source.

When considering plan wise growth of RE energy, a significant growth of solar power sector can be seen from the beginning of Twelfth Plan which may be attributed to the launch of JNNSM (Jawaharlal Nehru National Solar Mission) under the NAPCC. The Government of India has upscaled the RE targets to 175 GW which includes 100 GW from solar, 60 GW from wind and 10 GW from bio power and 5 GW from small hydro power. It is noted that only small hydro is eco friendly.

7.2.2 Overview of Solar Energy Scenario

The cumulative growth of global SPV capacity reached about 227 GW in the energy mix as in 2015, from 6.7 GW in 2006 with an AGR of 49.13 per cent and a CAGR of 47.90 per cent. China continues to dominate worldwide solar PV capacity accounting for 43.5 GW and India stands in the 7th position in worldwide PV capacity installations with 6.8 GW as on 2016. And in the case of Year-wise Solar Power Installed Capacity Cumulative-Growth, the solar installed capacity has increased from 513 MW at the end of 2011-12 to 9012.85 MW at the end of 2016-17 with an AGR of 84.5 per cent and a CAGR of 77.39 per cent. The market is expanding with a significant growth in installed capacity of PV faster than ever. It is also noteworthy that solar tariff has hit a historic low of Rs. 2.44 per kWh in 2017**.**

7.2.3 Kerala Solar Energy Scenario

When considering the growth trend of each source in the total Electricity Installed Capacity mix of Kerala, RE shows an increasing trend from 33.68 MW during 2010-11 to 57.4 MW in 2015-16 with an AGR of 13.62 and a CAGR of 11.25 MW during the period. As in the case of Indian RE trend, It is also found to be the highest growth rate while compared with other sources. However it accounts for two per cent during 2015-16 with an absolute figure of 57.4 MW from RES.

While looking at State-wise Renewable Energy Potential, there is a wide gap between potential and present installed capacity. It is noted that out of total Indian RE potential, solar energy potential accounted for 83 per cent. In Kerala, it is important to note that out of the total RE potential, around 70 per cent is solar energy**.** Solar installed capacity of Kerala currently reached around 90 MW which is only 1.47 per cent of the solar potential of the State.

Kerala shows a solar PV potential of 6 GW contributing 0.8 per cent to overall national solar energy potential, while the installed capacity is 0.17 per cent of the overall national installed capacity with an absolute figure 15.86 MW. Kerala occupies the 23rd position in India in solar energy potential, whereas it was in the 20th position with a solar power installed capacity as in 2016.

When considering top 10 states in solar energy potential and installed capacity share, we can observe a mismatch. Some states occupy higher rank in solar

energy installed capacity even though they are low in rank when considering solar energy potential. So it can be inferred that higher per cent solar energy installation level is not always directly related to states potential.

Regarding State-wise Cumulative Installation of SPV Systems**,** Kerala stands in the 7th position among Indian states with 54367 solar lantern distribution, 10th position with 4042 solar home lights distribution, occupies 21st rank in with 1735 solar street light installations, 15th with 810 solar pump distribution and third in standalone power plant installation with 13894 KWp up to 2016.

When looking into Solar Resource Analysis of Kerala, as a general principle, any site which was GHI of more than 1500 kwh/m^2/year is suitable for solar PV technology and this indicates that Kerala is highly suitable for developing solar PV systems. At the same time the resource values do not support suitability of solar thermal power generation because the average DNI is significantly less than the threshold value of 1800 kwh/m^2/year required for such projects. (The Energy Report – Kerala, wwf & wise 2013). As a contradiction, thermal solar applications like SWH are more familiar in Kerala.

Regarding decentralized Rooftop PV power Potential in Kerala (MW), the estimation from the WISE report in which the assessment indicates the total exploitable potential for decentralized solar PV power packs for household sector is about 13079MW, while that for Institutional or commercial sector is about 18066 MW. The aggregate potential for decentralized solar PV power packs is assessed at 31145MW.As per the RPO notified by the Regulatory Commisssion, Solar power purchase obligation for distribution licencees is 0.25% of total energy consumption for the year 2010-11 which will increase every year to reach 3 per cent by 2022.

7.3 Findings based on primary analysis

Based on the analysis of the data collected from the SPVPP consumers in Kerala, major findings with regard to primary data analysis are shown under different heads in the following pages.

7.3.1 Findings based on Descriptive Statistics of the sample RTPV consumers

A**.** Demographic Profile of the sample RTPV consumers

The summary of the demographic profile of the sample RTPV consumers was listed below:

Present study consists of 315 sample RTPV consumers in Kerala. In order to gain insight into the impact of various socio demographic factors, it seems highly relevant to get an idea about the demographic profile of the respondents.

1. Gender-wise analysis reveals that more than three fourth (89.2 per cent) of the sample RTPV consumers were male.

2. As far as area is concerned, majority (53.3 per cent) of the sample RTPV consumers belong to urban and14.9 per cent belong to suburban area. It should also be noted that 31.7 per cent belong to Panchayat.

3. Education wise analysis shows that 39.4 per cent of sample RTPV consumers have professional qualifications, followed by 27 per cent graduates, 16.8 per cent Post graduate persons, 11.7 per cent undergraduates and 5.1 per cent diploma holders.

4. As regards occupational status, most of the sample RTPV consumers (35.2 per cent) are employed in the government sector, 27 per cent are professionals, 19 per cent engaged in business/ self employment and 18.7 per cent are private sector employees.

5. Income wise analysis shows that 41.9 per cent of the sample RTPV consumers belongs to 'above Rs. 50000' income category, followed by 22.2 per cent having an income of 'Rs.20000-Rs.30000', 13.7 per cent between 'Rs. 30000 and Rs.40000', 12.7 per cent belong to 'below Rs.20000'category and 9.5 per cent belong to 'Rs.40000 to Rs.50000'. It can be inferred that the majority are from high income group.

6. With respect to age-wise analysis, it is seen that three fourth of the RTPV sample consumers (70.8 per cent) belong to the age group of 50 and above category. Also it should be noted that the age group '20- 30 years' constitutes only 2.54 per cent.

7.3.2 Possession of SPV and SWH

The study reveals that more than half of the RTPV sample consumers possessed (56.5 per cent) only RTPV system, whereas remaining consumers possess both RTPV and SWH.

7.3.3 Years of Usage

Findings related to years of usage indicate that more than half of the RTPV sample consumers (54 per cent) owned RTPV system for three years.

7.3.4 Usage of Electric Inverter

The results of the data analysis regarding the usage of electric inverter reveal that more than three fourth of the sample RTPV consumers (71.4 per cent) were using conventional type of electric inverter before shifting to solar energy technology.

7.3.5 Capacity of SPV system

Important findings related to capacity of SPV reveal that a majority (94.3 per cent) of RTPV sample consumers adopted 1 KW capacity SPV, whereas remaining (5.7 per cent) consumers adopted more than 1KW system.

7.3.6 Users Perception/Opinion regarding Monthly Output of the system

The analysis regarding monthly output of the SPV system reveals that 67.80 per cent of the sample RTPV consumers received within a range of '51 to 100 units of electricity' per month, generated by the system, as against the claim of ANERT, 4 units per sunny day. 18.22 per cent respondents recorded a monthly electric output of above 100 units from their installed system. Lastly, only 13.98 per cent recorded monthly electricity output within 50 units. This may be due to geographical differences.

7.3.7 Users Perception/Opinion regarding Payback Period of SPV

Data analysis regarding the perception of the respondents of the pay back of the system reveals that 50 per cent of the RTPV sample consumers are of the opinion that the system would pay back within 10 years. 34.61 per cent of respondents recorded that it would take 11 to 20 years to break even and 11.54 per cent of the

respondents recorded that it would be 20 to 30 years while only 0.85 per cent of the respondents marked it as above 30 years. It can be concluded that it was just a heuristic calculation and not by any pay back calculations using financial metrics.

7.3.8 Preference of off-grid and on-grid (MPS)

Majority of the RTPV sample consumers prefer off-grid system with a mean score of 4.2549 with an SD of 3.30232. Preference for on-grid stands second with a mean score of 3.7124 with an SD 2.89301.

7.3.9 Electricity consumption per day

With regard to per day electricity consumption, results show that 79.63 per cent of the sample RTPV consumers belong to the category of low electricity consumption per day (less than 9 units) following 17.9 per cent falling with the category of 10 to 17 units per day and only 2.47 per cent belong to high electricity per day consumption which is more than 17 units.

7.3.10 Phase Connection

Regarding Phase connection, the study ascertained that most of the sample RTPV consumers were three phase consumers (58.26) and the remaining category belongs to one phase connection**.**

7.3.11 Maintenance Charges per Year

It is found that more than three fourth of the sample RTPV consumers (71.15 per cent) reported a maintenance charge up to Rs.500/- for one year, whereas 20 per cent of respondents recorded a maintenance charge of Rs.501/- to Rs.1500/- and 7.69 per cent recorded it above Rs.1501 to Rs.2500 and 0.96 claimed that they had incurred above Rs.2500 as yearly maintenance charge.

Model Analysis

7.4 Dimensionality checking through EFA Model Constructs

Exploratory factor analysis (EFA) of reliability and dimensionality identified the six dimensions of Satisfaction, seven pre adoption factors which considered as the antecedents of CAI (Continued Adoption Intention-Mediator), and outcome

variables Repeated Purchase Behaviour (RPB) and Positive Word of Mouth (PWOM). The results of EFA 1 identified the dimensions of SAT as Product oriented factors, price, communication, convenience, ease of use, and service oriented aspects. The results of EFA 2 indicate that Antecedents to mediator (CAI) which involve seven dimensions which were Awareness regarding RTPV (AWA), Economic Factors (EF), Environmental Attitude/Relative Advantage (EA/RA), Buyer Social Responsibility (BSR), Attitude towards Government Initiatives(ATGI), Perceived Usefulness(PU), and Subjective Norm (SN) and EFA 3 identifies Outcome factors as Continued Adoption Intention (CAI) Positive Word of Mouth (PWOM) and Repeated Purchase Behaviour (RPB) which represent the emotional and behaviour loyalty respectively.

7.5 Fitness of Model Constructs through CFA

The dimensionality identified through EFA was subsequently reconfirmed by doing three CFA and by measuring overall fitness indices to the constructs. There are two measurements to confirm the validity of the constructs used in the model, namely convergent validity and discriminate validity. The estimates are well above the threshold and all the fit indices revealed a good fit for the model. The model fit was evaluated using the fit indices and all the indicators were found to be loaded significantly into the respective factors. All constructs met the basic threshold for reliability also.

7.6 Testing of Model Hypothesis through SEM

Antecedents to Satisfaction

Hypothesis testing using SEM technique proved that Product Oriented Aspects (POA) (β=0.134, p< 0.01), Price (β=0.192, p< 0.01), Communication (COMN) (β = 0.230, p< 0.01), Convenience (CON) (β = 0.124, p< 0.01) Ease of Use (EOU) (β = 0.154, p< 0.01) and Service Oriented Aspects (SOA) (β = 0.616, p< 0.01) are found to have significant positive impacts on satisfaction towards RTPV.

When considering Standard estimate of SAT dimension, Service Oriented Aspects (0.585) are found to have a most significant positive impact on SAT following Communication (0.276), Convenience (0.183), Ease of Use (0.174) price (0.171) and product quality (0.059).

Antecedents to Mediator (CAI)

When considering antecedents of mediating variable (CAI), the hypothesis tested through SEM reveals that Awareness Level regarding RTPV System Features (β = 0.114, $p< 0.01$), Economic Factors (EF) (β = 0.316, $p< 0.01$), Environmental Attitude /Relative Advantage (β = 0.612, $p< 0.01$), Attitude towards Government Initiatives (β = 0.132, $p< 0.01$), Buyer Social Responsibility (β = 0.133, $p< 0.01$), Perceived Usefulness (β = 0.614, $p< 0.01$), and Subjective Norms (β = 0.51, $p< 0.01$) was found to have the significant positive relation with CAI towards RTPV. Therefore this dimension has a significant role in deciding CAI of RTPV in the Kerala context.

When considering standard beta coefficient, Perceived Usefulness was found to be the most positive impact on CAI (0.523), followed by Economic Factors (0.485), Environmental Attitude /Relative Advantage (0.315), Subjective Norm (0.315), Buyer Social Responsibility (0.164), Awareness regarding RTPV (0.123) and ATGI (0.121)**.**

Outcome Variables

SAT has a positive impact on CAI. Model testing also proved that CAI has a positive impact on RPB (β = 0.23, $p< 0.01$) and PWOM (β = 0.57, $p< 0.01$). When considering the standard estimate, intention to PWOM is greater than RPB.

The objective of the research was to clarify the relationship between the relevant constructs from prominent theories in pre and post adoption behaviour of RTPV context. Exploratory factor analysis of reliability and dimensionality, identified the six dimensions of SAT, seven pre adoption factors which were considered as the antecedents of CAI (Mediator), and outcome variables, viz. RPB and PWOM and reconfirmed it through CFA. Model testing results show that SAT is the key antecedent of CAI and has an indirect positive effect on RPB and PWOM. The effects of pre adoption factors will have a positive impact on CAI. Additionally, customer satisfaction can enhance consumer loyalty. Thus, the research model proves that there is a significant influence of SAT on CAI and subsequent outcome variables.

All the sixteen proposed hypotheses were supported and the model is very robust and fits well with the data. Therefore it can be concluded that the antecedents

of SAT have a considerable effect on SAT. Further, SAT has a positive impact on CAI which leads to RPB and PWOM. Moreover, the effect of pre adoption factors on CAI reflects a new contribution to the existing literature.

7.7 Additional Findings based on Perceptions of Domestic Users towards RTPV market

7.7.1 Awareness Regarding Different Types of Solar Energy Products among RTPV consumers in Kerala

One sample t test regarding awareness about different types of solar energy products among RTPV consumers in Kerala reveals a statistically significant result for SPV, SWH solar lantern, solar street light, solar cooker, solar home pack, solar bag, solar cap and solar dryer. However, the result found to be insignificant for solar pump and solar mobile charger means these products have at least average level of awareness. Mean score analysis revealed that SPV is the highest familiar product among Kerala RTPV consumers followed by SWH, solar street light, solar cap. Likewise least awareness is found about solar bag, solar cap, solar dryer and solar home pack.

7.7.2 Awareness regarding RTPV

One sample t test regarding RTPV system Awareness among users in Kerala reveals a statistically significant result for all aspects except for three aspects which are 'FIT', 'Net Metering', and 'need of small battery backup for uninterrupted working of on-grid system during power cut', which shows an average level of awareness. Mean score analysis revealed that there is highest awareness regarding 'electricity reduction', 'green aspect of SPV product', 'cost saving', 'awareness about cost of battery replacement after 5 years and its approximate cost', 'sustainability', 'capital subsidies', 'awareness of the fact that after battery is charged full, further charging is not possible', 'awareness about on-grid', 'awareness on the condition that on-grid will not work during power cut', 'awareness of the fact that 'the inverter should be changed in the case of a transformation from off-grid to on grid', 'awareness about government policy relating to mandatory implementation of 1KW rooftop solar for houses more than 2500 sq.ft' and 'awareness about the new scheme of the Government namely solar connect'. But there is least awareness about 'solar

hybrid system', 'requirements for getting CERC reduction', and 'awareness about CERC order relating to reduction of monthly electricity bill'.

Factor Analysis of RTPV Awareness

Factor analysis was used to extract the various dimensions of awareness of this technological innovative energy product. The result of EFA with 20 identified variables reveals that the four dimensions were policy-related, economic and sustainability linked, technical requirements and future financial requirement.

Opinion regarding Effectiveness of Media for getting Awareness about Solar Energy Product

One sample t test regarding the opinion relating to the effectiveness of media for getting awareness about solar energy product among users in Kerala reveals statistically significant results. It shows significant difference from average value and it is inferred that the perceived effectiveness of all media is above average. Mean score analysis reveals that TV advertisement is the most effective medium in disseminating the awareness about solar energy products followed by print media, ANERT awareness campaign, exhibitions, friends and relatives, Internet and solar dealers.

7.7.3 Influencing factors for selecting Company

One sample t test regarding influencing factors for selecting Company among RTPV users in Kerala shows significant results except two factors namely 'advertisement' and 'offering innovative features'. It is inferred that the perceived effectiveness of these two factors is average. The most important reason which influenced the sample RTPV consumers for selecting the company for RTPV adoption was credibility of the company followed by high quality of the system, brand image, reasonable price, easy accessibility, year of experience, opinion from friends and relatives, good rapport with the distributor, and offers and discounts.

Economic Factors (EC)

One sample t test has been done to know the level of importance given to each factors in this dimension while adopting RTPV by consumers in Kerala. The analysis shows significant results, except one which is 'adoption of solar if there is no

subsidy'. Mean score analysis reveals that all other items show an above average value. The first important economic factor while adopting RTPV, considered by the consumers, is the 'economic saving through reduction in the electricity bill'. The second important economic factor is 'minimum maintenance'. The third is, 'less operational cost' followed by 'solar energy will become competitive if external costs of fossil fuels considered', 'Adopted solar because of government subsidy', 'safe from rising trend of future energy costs', 'SPV installation is an Added value to property', 'Solar adoption by considering ROI', 'SPV adoption without subsidy' and 'solar is affordable without subsidy'.

Attitude towards Government Initiatives (ATGI)

One sample t test regarding ATGI factors among RTPV users in Kerala shows significant results for all six factors (above average). It can be inferred that there is a high level of positive attitude towards government initiatives which act as a drive, while adopting RTPV. While looking at the mean score, there is a strong attitude towards the mandatory environment which will be created by the government in future regarding solar energy adoption. '10000 solar rooftop programme', and 'joint efforts of SNAs, DISCOM and NGOs for making solar programme successful' stands first in this dimension followed by 'launching of new schemes namely solar connect scheme for on-grid RTPV', 'strict government rules and regulations across the world' and 'effectiveness of ANERT awareness programmes'.

Perceived Usefulness (PU)

One sample t test regarding perceived usefulness among RTPV users in Kerala shows significant results for all six factors and it can be inferred that there is a high level of importance given by the consumers. The Mean score analysis reveals that the most important influence among PU factors is 'uninterrupted power supply', whereas the second is 'economic aspects by means of reduction of electricity bill'. The third important factor considered by the respondents is 'conventional fuel saving' followed by 'peak time electricity consumption reduction', 'protection against rising cost of fossil fuel energy', and factor 'reduction in idle hours due to power breakdown'.

Environmental Attitude/ Relative Advantage (EA/RA)

Regarding an in-depth analysis of EA, one sample t test in respect of environmental factors among RTPV users in Kerala shows significant results for all items and it can be inferred that there is a high level of importance for each environmental factor. Most important influencing factor among RA/EA is 'reduction in carbon footprint', whereas the second is 'improvement of public health by reducing pollution'. The third important influent is 'Production of own Renewable Energy' followed by ' being part in green path of global development', 'Reduction of Green House Gases(GHGs)', 'demonstration of environmental responsibility', 'preventing global warming impacts', 'silent operation', 'Reduction of the impacts of eco system', 'better quality of life' and 'meeting expectation of sustainable products'.

Buyer Social Responsibility (BSR)

Regarding BSR, related to energy, the results of one sample t test reveal that there are significant results in all factors related to BSR and it can be concluded that consumers possess a higher level of importance towards each factor related to BSR. Mean score analysis reveals that there is a 'higher concern for using risky sources of energy'. Second factor is 'enhancing energy security'. Third important factor is 'Role in eliminate energy poverty' followed by 'Abundant source of energy'. 'Reducing rural energy poverty', 'Comprehensive solution for electricity', 'Reduction of dependence on energy from other states or countries', 'Achievement of Millennium Development (MDGs)', 'Savings on expenses of new conventional power plants', and 'Reduction in transmission and distribution infrastructure'.

Subjective Norm (SN)

One sample t test regarding the determinants of subjective norms to know the relative importance of each factor was used in this dimension. Significant results were revealed for all factors related to SN except one which is 'influence of friends'. 'Role of prestige among society' as well as 'family support and encouragements' scores high mean values which indicates that consumers have given more relevance to these aspects. However, 'Friends and colleagues' support' showing a low value below average that means it doesn't have significant influence.

Level of Pre Adoption Factors on RTPV Adoption

One sample t test was done to know the level of importance given to pre adoption factors by the consumers while adopting RTPV. The results reveal that there are significant results found at $p<0.01$ in all seven factors and it also indicates an above average level. Therefore, it is assumed that there exists a strong involvement of seven determinants on RTPV adoption.

The mean score analysis reveals that the 'RTPV Awareness' was the most important factor while taking up RTPV adoption. Secondly, the consumers give importance to Social Responsibility Factors. Third factor is Environmental Attitude/Relative Advantage. Fourth position goes to Economic Factors followed by Attitude towards Government Initiatives, Perceived Usefulness and finally Subjective Norms.

Satisfaction regarding Product Oriented Aspects of RTPV

One sample t test regarding the satisfaction level about the quality of products and components among residential users of RTPV in Kerala reveals a significant result for each aspect and shows high level of satisfaction. It should be noted that the respondents are highly satisfied with the 'quality of panel'. They are also satisfied with 'good quality of inverter' following 'battery quality', 'electricity generation as expected' and 'battery capacity'. It should be noted that they have low level of satisfaction in the case of 'their present installed capacity of their system'.

Satisfaction regarding Price

The findings of one sample t test regarding the satisfaction level in respect of the price of RTPV system among the residential users reveal a significant result. The respondents have above average level of satisfaction regarding the price charged by the company. But they are of the opinion that if the payment is made in installment, it will be more affordable.

Satisfaction regarding Ease of Use (EOU)

The findings of one sample t test of the satisfaction level regarding Ease of Use of the system among residential users reveal a significant result for three factors except one/two which is ' There's no difficulty in filling water in battery'. It should be

noted that the respondents are highly satisfied with 'Better Usage experience' following 'Usage without frequent failure after installation'. However, Respondents have low level of satisfaction about 'filling water in battery' and 'switch over from solar to grid electricity'.

Satisfaction regarding Service Oriented Aspects (SOA)

The findings of one sample t test regarding the satisfaction level of SOA of SPV system among residential users reveal significant results in all factors related to SOA. It should be noted that customers' satisfaction will be above average for the opinion that 'if the companies do the maintenence services every 6 months' (Emapthy). Secondly, 'Installation works done by the company' (Tangibiliy). Thirdly, 'Timely installation' (Reliability) followed by 'Credibility of providers' (Assurance), 'Not incurred any additional expenses' (Assurance). The respondents recorded a low level of satisfaction regarding 'Timely getting service' (Responsiveness), 'Companies responsibility of reinstallation after 20 years (life period of the system)' (Assurance), 'There is no such situation prevailing to call the company after installation for any failure' (call company for failure-Assurance), and 'Monitoring of system in every 6 months'(Assurance).

Thus it can be observed that high satisfaction is found in some aspects of Empathy, Tangibility, Assurance and Responsiveness and a low level of satisfaction is found in responsiveness and three statements regarding assurance. Therefore the company should give more focus into the 'responsiveness' and 'assurance' dimension.

Communication (COMN)

The outcome of one sample t test regarding the satisfaction level of communication aspects of SPV system among residential users reveals significant results in all factors related to communication aspects. Customers reported high level satisfaction in 'providing information regarding filling of water in batteries', followed by 'cleaning of panels', and 'Better customer support'. However satisfaction is low with respect to giving 'latest updates about new developments of the system' (on-grid system) and 'promotional activities'.

Convenience (CON)

The outcome of one sample t test regarding the satisfaction level of convenience aspects of SPV system among residential users reveals significant results in all factors. It should be noted that customers reported a high level of satisfaction in 'Availability of authorized dealers of the company', following 'Availability of components' and 'Accessibility of company'.

Level of Satisfaction towards RTPV in different dimensions among users

When considering six dimensions (Antecedents of SAT) the findings of one sample t test at 1per cent level of significance reveal significant results and all items were found to have above average value. Therefore it is assumed that the satisfaction regarding different dimensions of RTPV is high among RTPV users in Kerala.

The results reveal that the RTPV users are more satisfied with Service Oriented Aspects followed by Product Oriented Aspects, Communication, Ease of Use, Convenience, and Price.

7.7.4 Impact of demographics on Awareness regarding solar energy products

A demographic analysis with respect to Awareness Regarding Types of Solar Energy Products reveals that gender ($t= 3.001$, $p=0.003$), income ($F=3.664$, $p=0.006$) and education levels ($F= 2.762$,$p=0.028$) of the RTPV consumers in Kerala found to be statistically significant.

Gender-wise classification reveals that the mean awareness regarding solar energy products was higher among male respondents ($\mu=28.81$) than females **($\mu=$).**

Income-wise analysis reveals that the awareness level of 'Above Rs.50000' group is higher and the low level of awareness is shown among 'Below Rs.20000' group. Subsequent multiple comparison test using tukey USD regarding income shows that the awareness in respect of solar energy products of RTPV consumers who had monthly income of 'Below Rs.20000' category is significantly different from those who belong to other income groups.

Education-wise analysis shows that the highest awareness was shown by the group having 'Professional degree' qualification and the lowest was showed by the 'Undergraduates' and 'Diploma holders' group.

Subsequent multiple comparison test using tukey USD shows that significant difference exists among different educational categories, viz. UG and Professional qualification with a mean difference of 4.20379 and Graduate and Professional qualification with a mean difference of 2.4015, as well as diploma holders and professional degree holders with a mean difference of 4.6089.

However, it is observed that area (F=0.256,p=0.774), age (F=0.873,p=0.455), occupation (F=0.639, p=0.590) and District (F=0.124, p=0.946) wise variation is not significant.

7.7.5 Impact of demographics on the opinion regarding Effectiveness of alternative information sources

The result of One Way ANOVA and Independent Sample t test of demographic analysis with respect to the opinion regarding Effectiveness of alternative information sources reveals that education is the only variable found to have significant difference in media perception (F=2.551p=0.039). The opinion regarding effectiveness of different promotional tools was found to be high among Diploma holders and low among Graduates. Subsequent Multiple Comparison analysis using Tukey USD revealed that significant difference existed between the education group 'graduate and diploma' with a mean difference of 2.34706 and 'graduate and professional qualification' with a mean difference of 1.79867.

There is no significant difference in Gender (t= 1.300, p= 0.195), area (F= 0.822, p= 0.440), income (F= 1.118, p=0.348), occupation (F=1.805, p=0.146), age (F= 0.466, p=0.706) and district (F= 1.046, p=0.373).

7.7.6 Impact of Demographics on Choice of Suppliers

The result of One Way ANOVA and Independent Sample t test with respect to Choice of Suppliers reveals that there is no significant variation towards selection of suppliers with gender (t=0.049, p=0.961), area (F=0.478, p=0.620), income

(F=1.391, p=0.237), educational qualification (F=0.803,p=0.524), occupation (F=2.167, p=0.092), age (F=1.183, p=0.141) and district (F=2.204, p=0.088).

7.7.7 Impact of Demographics on Awareness regarding RTPV system features

One way ANOVA and Independent sample t test (at 5 per cent level of significance) were computed to test the statistical significance of the hypothesis and the results show that there is significant variation between gender and RTPV awareness. However, there is no significant variation towards RTPV awareness with area, income, education, occupation, age and district.

Gender-wise classification shows that RTPV awareness is higher among male RTPV consumers (μ=41.84) than female RTPV consumers (μ=35.29).

7.7.8 Impact of Demographics on Economic Factors

Independent sample t test and one way ANOVA were used to study whether there is a significant difference in the concern for economic factors with socio demographic variables. Results show a significant mean difference among consumers with different income levels and districts.

Income-wise analysis shows that the consideration of economic factors are high among monthly income 'below Rs.20000' group and low among monthly income 'Rs.40000 to Rs.50000'. Subsequent analysis using multiple comparison test using Tukey USD show that the to Monthly income of 'Rs.40000-Rs.50000' was significantly different from other income groups.

District-wise analysis also shows that the importance of economic factors were high in 'Malappuram' district and low in 'Thiruvananthapuram' district. Further analysis using post hoc test reveals that the economic factors differ with consumers belonging to 'Thiruvananthapuram' (μ=27.5) and Thrissur (μ=25.14) and Thiruvananthapuram (μ =27.5) and Malappuram (μ =24.97) & Ernakulam (μ =26.84) and Thrissur (μ =25.14).

7.7.9 Impact of Demographics on Attitude towards Government Initiatives (ATGI)

Inferential statistics regarding Customers' attitude towards government initiatives for SPV penetration reveals that there is significant difference in ATGI with income (F=3.426, p=0.009) and educational level (F=4.247, p=0.002) of the consumers. However no significant difference is seen with gender (F=0.336, p=0.737), area (F=1.170, p=0.312), occupation (F=1.059, p=0.367), age (F=0.283, p=0.838), and district (F=1.855, p=0.137).

Income-wise analysis shows that the influence of attitude towards government initiatives is high among monthly income group of 'below Rs. 20000' (μ =27.70) and low among 'Rs.40000- Rs.50000' (μ =24.33) income group. Subsequent Multiple comparison test using Tukey USD reveals that significant difference exists between the income group 'Below Rs.20000' and 'Rs.20000- Rs.30000', group 'Below Rs.20000' and 'Rs.50000 above', group 'Rs.20000- Rs.30000' and 'Rs.40000- Rs.50000' as well as 'Rs.20000- Rs.30000' and above 'Rs.50000'.

Education-wise analysis shows that the ATGI while adopting RTPV system is high among 'undergraduates' group (μ =28.11) and low among professional degree holders (μ =24.95). Subsequent Multiple comparison test using Tukey USD reveals significant difference exists between different educational groups UG and Graduate, UG and Professional, and PG and Professional degree holders

7.7.10 Impact of Demographics on Perceived Usefulness (PU)

Socio demographic-wise analysis regarding perceived usefulness shows no statistically significant result.

7.7.11 Impact of Demographics on Environmental Attitude/ Relative Advantage (EA/RA)

There is no significant variation in factors regarding environmental attitude with demographic characteristics, except income. Income-wise analysis shows that EA/RA is high among 'Rs.50000 above' monthly income group (μ =49.51) and low among 'Rs.30000-Rs.40000'income group (μ=46.70). Subsequent Multiple comparison test using Tukey USD reveals that there is a significant difference

existing between the income group Rs.30000- Rs.40000 and Rs.50000 above, and Rs.40000- Rs.50000 and above Rs.50000.

7.7.12 Impact of Demographics on Buyer Social Responsibility (BSR)

The construct BSR has been analyzed on the basis of socio demographic variables of RTPV consumers, viz. gender, area, levels of education, occupation status, monthly income age and district. The result of the analysis shows that there is no significant variation in factors regarding BSR with demographic characteristics.

7.7.13 Impact of Demographics on Subjective Norms (SN)

There is significant difference seen against SN with districts of the consumers. However no significant difference with gender, area, educational qualification, occupation and age. District wise analysis reveals that SN found to be high among TVM district (μ=9.79) and low among Malapuram (μ =8.19). Subsequent multiple comparison test using Tukey USD reveals that there is a significant difference exists between the districts TVM and TCR, TVM and MLPM.

7.7.14 Impact of Demographics on Antecedents of Satisfaction Regarding Rooftop Photovoltaic (RTPV)

There is no significant variation in the satisfaction dimensions regarding PROQLTY, Price (Cost), COMN (Communication), CON (Convenience Related Aspects), SOA (Service Oriented Aspects), EOU (Ease of Use) and factors with demographic variables.

7.7.15 RPB (Repeated Purchase Behaviour)

The result of Independent sample t test and One Way ANOVA 5% level shows that there is significant difference in RPB with districts (F=3.473, p=0.016) of the consumers. However, there is no significant difference in gender, area, educational qualification, occupation and age. District wise classification shows that higher RPB behaviour is exhibited by the RTPV consumers of EKM district (μ =12.51) and least in MLPM district (μ=11.19). Subsequent multiple comparison test shows that there exists significant difference between the districts EKM and TCR, EKM and MLPM.

7.7.16 PWOM (Positive Word of Mouth)

The result of inferential statistics at 5 per cent level shows that there is significant difference in PWOM with Area (F=6.832, p=.001), income (F=353.6, p=0.000), Education (F=18.575, p=0.000), and occupation (F=9.306, p=0.000). However, there is no significant difference with gender, age and district.

Area-wise classification shows that PWOM intention of RTPV consumers who belong to Corporation area (μ = 11.58) is higher and low intention is found in Panchayat (μ =10.09).

Likewise, Income-wise classification shows that PWOM intention was high among RTPV consumers of monthly income of 'Rs.50000/- Above' group (14.07) and low in monthly income of 'Rs.20000/- below' group (μ =6.102). When considering education, PWOM Intention is found high in consumers having 'professional qualification' (μ=12.52) and low in Diploma holders (μ =9.87) and lastly, occupation wise classification reveals that, a high PWOM intention prevails among Professionals (μ =12.48) and low in private employees (9.86).

Subsequent Multiple comparison tests using Tukey USD reveal that significant difference exists between 'panchayat' area with 'corporation' and 'Municipality'.

7.8. Findings from dealers perspective

7.8.1 Spread of RTPV Dealers across Urban and Rural Areas: More than 90 per cent (91.3) of the RTPV dealers are from urban area.

7.8.2 Year of Experience in Solar Energy Sector Market in Kerala: A majority (43.5 per cent) of the RTPV dealers have more than four years of experience.

7.8.3 Nature of Dealers: More than half (52 per cent) of the RTPV dealers are MNRE channel partners while 48 per cent included in ANERT selected company dealers.

7.8.4 Type of dealers based on functions: Based on the functions performed by dealers, more than half (52.2) of the sample RTPV dealers were doing only system integration**.** In addition, some of the system integrators are doing component manufacturing and sub-contracting.

7.8.5 Type of Solar Energy Products deals by RTPV dealers in Kerala: More than half (61 per cent) of the RTPV dealers are concentrated on both SPV and SWH.

7.8.6 Type of RTPV system: More than three fourth (78 per cent) of the sample RTPV dealers dealt with both off-grid and on-grid SPV technology.

7.8.7 Type of PV technology used by the RTPV companies in Kerala: When considering PV panel technology, more than three fourth (73.9 per cent) of the sample RTPV dealers selected poly crystalline technology.

7.8.8 Cumulative PV Installations of RTPV Dealers in Kerala: When considering installation experience, a majority of the dealers have a cumulative installation experience of less than 100 KW.Only 26.08 per cent RTPV dealers had an experience of installing more than 1000 KW.

7.8.9 Area of operation: More than half (65.2 per cent) of the sample RTPV dealers restricted their area of operation within the State, while 17.4 per cent of the sample RTPV dealers spread their operations internationally.

7.8.10 Promotional Tools used by RTPV Dealers: More than three fourth (73.9 per cent) of the sample RTPV dealers used Advertisement in TV and press media, whereas 50 per cent used press advertisement only. It should be noted that 26 per cent of the sample RTPV consumers are not doing any promotional effort.

Cost of components and Labor

More than half (56.35 per cent) of the components are Indian made. It should be noted that 44.17 per cent of the components are imported and labour cost is only 15.14 per cent.

7.8.11 Support from Banks: More than three fourth (87 per cent) of the sample RTPV dealers are not receiving any support from banks.

7.8.12 Type of support from Government from the point of view of Dealers: In the opinion of dealers, incentive to buyers would promote the RTPV market followed by incentive to system integrators. 43.5 per cent of dealers reported that incentives to buyers will promote this market while it should be noted that 21.7 per cent reported the rejection of incentives.

7.8.13 AMC:

More than three fourth (78.3 per cent) of the sample RTPV dealers provide AMC.

7.8.14 Average Number of Visits to Customers for AMC: 78.3 per cent conducted 1 to 3 times visit annually.

7.8.16 Strengths: When considering strengths, product quality (6.57) is ranked first by the sample RTPV dealers followed by credibility (5.14), after sale service (4.83), market knowledge (4.45), supply chain management (3.22) and price (2.77). It is important to note that market knowledge came fourth and is also weak in supply chain management. Price remains a barrier.

7.8.17 Cost of components and Labour: Regarding cost of components, sample RTPV dealers reported that an average of 56.55 per cent cost was attributed to Indian made components. 44.17 per cent belong to imported components. 15.14 per cent cost was allocated for labour. Therefore it can be concluded that cost of components of RTPV remains higher in the overall cost**.**

7.8.18 Consideration of Rural Area customers: More than three fourth (77.3 per cent) of the sample RTPV dealers consider rural area consumers as their target market segment.

7.8.19 Provision for financial means to customers: 95 per cent of the sample RTPV dealers did not implement any financial assistance in the form of discounts and offers. However, it should be noted that RTPV sample consumers survey results indicated a least influence of 'offers and discounts' in selecting RTPV company**.**

7.8.20 Preferable Scheme of Government for RTPV market: More than half (66.7 per cent) of the sample RTPV dealers preferred to on-grid scheme, i.e. 'solar connect scheme of government.

7.8.22 Importance of Barriers faced by the RTPV dealers in Kerala Solar Energy Market

The findings of One sample t test regarding the barriers faced by the dealers in Kerala RTPV market reveal at significant results at $p<0.01$ and $p<0.05$. The most important challenge was found to be Complexity of subsidy administration ($t=12.16$,

p=.000, M=4.55), followed by Tardy implementation of government decision (t=9.056, p=.000, M=4.55), Inadequate implementation of policies (t=6.753, p=.000, M=4.39), Lack of clarity in standards (t=6.750, p=.000, M=4.17), High initial cost of solar (M=4.17), Failure to account all costs and benefits (t=8.333,p=.000,M=4.14), Inadequate financing option(t=6.821,p=.000,M=4.09), Lack of consumer education (t=5.700,p=.000,M=4.04), Lack of equitable net metering and guidelines (t=3.686,p=.001,M=4.00), Cheap products are flooded in the market (t=4.041,p=.001,M=3.91), Lack of Awareness of consumer (t=4.309, p=.000, M=3.87), Lack of community involvement and support (t=4.534, p=.000, M=3.87), Misplaced incentives (t=3.356, p=.003, M=3.86), Unscientific fiscal and regulatory policies (t=4.202,p=.000,M=3.76), Not understanding the long term importance of solar energy(t=2.592, p=.017, M=3.73), Mismatch between market capability and actual achievement (t=4.461, p=.000, M=3.77), Lack of renewable energy investment climate Vs real estate (t=4.983, p=.000, M=3.77), Inconsistent government policies (t=3.367, p=.003, M=3.82), and Lack of ensuring quality of components (t=3.071, p=.006, M=3.68).

The result indicates that 11 barriers were insignificant, viz. complexity of the product, unable to provide after sale service, inadequate workforce skill, difficulty in overcoming established energy systems, lack of credibility of companies or dealers, difficulty due to inaccessibility, does not add value to property, inadequate installation and service, lack of familiarity with the technology among dealers, trends in conventional electricity costs and lack of communication within industry.

These thirty barriers can be grouped into four categories, namely policy-related, economic and financial, Socio technical and marketing.

7.8.23 Customer Satisfaction from dealer perception

The level of satisfaction of existing consumers with RTPV from dealers perspective shows a significant result. Mean value indicates that the satisfaction level is above average.

7.8.24 Dealer satisfaction on Government Scheme: The level of satisfaction of dealers with ‘10000 Solar Rooftop Power plant Scheme was found to be significant. Analysis also indicates a low level of satisfaction.

7.9 Discussion

The aim of the present study was to develop a model, and empirically evaluate the same which incorporates both pre and post adoption towards Rooftop Photovoltaic (RTPV). Firstly the study revealed the effects of users' satisfaction with their loyalty formation in the form of Repeated Purchase Behaviour (RPB), and Positive Word of Mouth (PWOM). Satisfaction considered as a key antecedent of Continued Adoption Intention (CAI) and the subsequent development of outcome variable, namely RPB and PWOM. Findings regarding antecedents of Satisfaction (SAT), proved that service oriented factors have the most significant positive impact on SAT, followed by Communication (COMN), Convenience (CON), Ease of Use (EoU), Price, and Product Quality. Additionally, the study found the significant positive impact on seven dimensions on CAI. Out of seven pre adoption of RTPV dimensions, namely Awareness(AWA), Economic Factor (EF), Environmental Attitude (EA), Attitude towards Government Initiative (ATGI), Buyer Social Responsibility (BSR), Perceived Usefulness (PU), and Subjective Norm (SN) contributed to pre adoption towards RTPV, perceived usefulness found to be the most significant positive impact on continued adoption Intention. Economic factors were found to have second important aspect on continued adoption Intention. Environmental attitude and subjective Norms' is the third important aspect. Buyer social Responsibility, AWA, and ATGI are the fifth, sixth and seventh important factors respectively.

Some additional findings include the opinion relating to general awareness in respect of solar energy products, the effectiveness of various media for getting awareness, and factors determining selection of company. Print and television media are marked as excellent by RTPV consumers and friends and relatives, exhibition, solar energy dealers, ANERT awareness campaigns, internet are grouped as medium effectiveness in spreading awareness. The opinion regarding the impact of media is found to be significant difference with RTPV consumers having different educational qualifications. Analysis revealed that significant difference exists between the education group 'graduate and diploma holders' and 'graduate and professional qualification'. The impact of media is low among graduates and high among professional and diploma holders. A plausible reason for this as it is a highly involvement product, graduate holders may need an in-depth information regarding the system which is currently not provided by a mere advertisement. The most

important reason which influenced the sample RTPV consumers for selecting company for RTPV adoption was credibility of the company. Further, there are no socio-demographic differences influencing factors for selecting company. Moreover, socio-demographic difference between pre and post adoption constructs reveals that there is significant difference in RTPV awareness, economic factors, ATGI, environmental attitude, and SN. However no significant differences are found in other model constructs. Further, regarding antecedents of satisfaction, there is no significant difference in socio demographic variables.

Firstly, the results show that all the proposed paths are significant in the hypothesized model. Finally, it would be imperative to get an insight in to the influencing effect of various determinants on RTPV adoption.

Findings indicate that the dimensions of SAT were Product-oriented factors, price, communication, convenience, ease of use, and service oriented aspects. And Outcome factors such as PWOM and RPB, forms the emotional and behavior loyalty. SAT was found to have direct effect on CAI. In addition to the direct effects, this research bats for the consideration of the indirect effects of SAT with RPB and PWOM via CAI.

Pre adoption factors are treated as the Antecedents to mediator (CAI) which involves seven dimensions which were Awareness regarding RTPV, Economic Factors, environmental attitude, buyer social responsibility, Attitude towards Government Attitude, perceived usefulness, and subjective norm. A majority of the RE adoption literature emphasized the effect of environmental and economic factors**.**

7.10 Major conclusions drawn from the findings of the study:

One of the main confronts actions faced by the energy sector in the State is negligible contribution of renewable energy to the energy mix. Solar PV possesses great untapped potential. However, the usage of this particular technology is still dwarfed. It can be inferred that a significant growth of solar power sector can be seen from the beginning of 12^{th} Plan which may be attributed to the launch of JNNSM (Jawaharlal Nehru National Solar Mission) under the NAPCC. The emphasis on green long term benefits and Government support will promote RTPV market initially.

After phasing out subsidy, improved quality, better service with affordable cost will ensure about long term market of RTPV.

Increasing environmental concern, legislation from government worldwide, radical shift in the mindset of consumers towards green products have led to the growth of solar energy industry. The concern for green products gradually shifted from developed to developing economies. Indian energy sector shows a significant growth in RE enhancement by fixing world's largest target by GoI by 2022. NAPCC and consequent JNNSM earmarked as pathlighter for the tremendous change in the energy mix by the transformation from gray energy in to green energy. Now RE is growing with a higher AGR when compared with the growth of other energy forms.

The major objective was to develop a unique model consisting of antecedents and consequences of domestic off grid RTPV adoption. The research outcome indicated that all of the sixteen hypothesized directions proved to be statistically significant. The most important determinant for continued adoption intention is satisfaction. Satisfaction is directly related to CAI and is indirectly related to RPB and PWOM via CAI. The role of SAT in consumers' post adoption behaviour is obvious. The results show that SAT is an immediate antecedent to consumer CAI and subsequent outcome variables. SAT affects RPB and PWOM indirectly through CAI. Analysis indicates that CAI is determined not only by SAT dimension but also proves the impact of pre adoption factors. Therefore analysis results show that SAT is the key determinant of RPB and PWOM development in the RTPV context which is mediated by CAI. The model appeared as robust in studying the pre and post adoption behaviour towards RTPV. Furthermore, an empirical study on off-grid domestic RTPV which considers the antecedents and consequences simultaneously is not found in existing literature.

When considering government intervened solar energy market, the MNRE accredited channel partners were responsible for the implementation of solar energy plants through government schemes of national level.

When looking at the ANERT mile stone, solar lanterns were familiar among consumers. Likewise SWH, street lights also are familiar.

Most of the consumers in Kerala are suspicious about this innovative sustainable technological product, due to solar scams and inability to differentiate between authorized and unauthorized players in the market. Unscrupulous trading and malpractices can be made possible as it is a highly complex and highly involved product.

It can be concluded that solar energy sector is in an emerging stage with a high growth potential. For achieving the solar energy policy targets, there is a high need of commercialization of this product. Care must be taken not to compromise with the quality of product and service in the interest of achieving targets. There requires enhancement of awareness regarding these types of technologies. Finally the need and scope for its recycling must be recognized by the companies and government. These will enhance the market share of RTPV. The resent study brings out various insights into the pre and post adoption behaviour for domestic RTPV and thus helps marketers and government who are engaged in promoting the penetration of RTPV and to modify their strategies.

For examining the determinants of RTPV, the researcher utilized some key constructs from widely cited models, like TRA, TPB, TAM, IDT. Numerous studies have endeavored to model the determinants of RET adoption by using these theories. Here in this research, the researcher tries to connect some key constructs from these models with additional constructs which are based on relevant literature. The researcher is attempting to explain how important the contribution of each variable is in (APB) Actual Purchase Behavior, SAT and CAI and finally creating loyalty by conducting the study among the owners/users of RTPV in Kerala.

The 4Ps concept here changed as 4Cs as it is described from a consumer's point of view. Product-related aspects and price remain the same. However, the researcher used the term 'convenience' for the 'place' which indicates availability of product. 'Promotion' is termed as 'communication' which means to the dissemination of information, updation of new knowledge relating to the product.

In this research, specific attributes contributing to satisfaction are taken as different dimensions, like 4Ps (Product quality, Price, Communication, Promotion), Ease of use and service oriented aspects. Price, Quality and Convenience are the drivers of consumer equity.

It should be noted that the level of involvement of pre adoption dimensions at the time of actual RTPV adoption was found to be high for RTPV awareness followed by BSR, EA/RA, EF, ATGI, PU and SN. At the same time, SEM reveals that the factor 'Perceived Usefulness' was found to have the most significant positive influence on 'continued adoption intention' following 'Economic Factor', Environmental Attitude, Subjective Norm, Buyer social Responsibility, Awareness, and ATGI. Similarly when considering the level of satisfaction towards different dimensions, it is revealed that the users were found to have the highest level of satisfaction in service-oriented aspects, followed by product-oriented aspects, communication, Ease of Use, convenience and price. When considering SEM analysis, SOA was found to have the most significant positive impact on satisfaction, followed by communication, convenience, Ease of Use, Price and product quality.

When RTPV is viewed from a marketing point of view, this product may possess the following features:

1) High involvement product
2) Complex
3) Dissonance reducing buying behaviour exhibited by the consumers after its adoption
4) Unsought Good
5) Eco-Innovative
6) Non-Existing Demand

Market segments for rooftop solar are residential, commercial, industrial, institutional and Govt. Buildings. Each customer segment exhibits some distinctive characteristics relating to market drivers, policy incentives, financial viability and business models. (Akshay urja, 2016)

Types of CB relating to RTPV (Innovative Green Products) may vary across different types of products, region and culture. RTPV in this research is considered as an innovative green energy product, and the marketers have to understand the stimuli that are operating in an innovative green marketing environment which makes the

consumers adopt the product. The consumers of RTPV may exhibit the following buying behavior:

1) Highly complex/involvement buying behaviour: Definitely, RTPV is a complex technological product, which needs high involvement of consumers. High involvement product means that RTPV is characterized by expensive, risky, infrequently purchased and highly self expressive product. Therefore consumers may search to avail themselves of maximum information relating to the system performance, functions and standards.

2) Dissonance reducing buying Behaviour: After adopting RTPV, a consumer may feel a mental discomfort (cognitive dissonance) when hearing the benefits of another brand of the same

It is evident that the consumer likes to exhibit and demonstrate greenness through their purchase behavior. Moreover, "Green" became the slogan of marketers, thereby helping to accelerate the growth of particular green product. So care must be taken by the marketers, when creating and communicating awareness and product benefits in these aspects. The marketers have been striving hard to influence the consumer through the marketing mix strategies.

7.11 Suggestions to Dealers/Marketers

1. Now a days, consumers are a very powerful element in the marketing process and they are aware of ethical and unethical buyer behavior and they have the freedom to boycott an unethical product. So if a product can make some socio-economic benefit, many of them (high income/high educated segment) may have Willingness to Pay (WTP) for the same. However, they never compromise with the quality /functionality and performance for the sake of social responsibility. Care should be taken to develop modules which suit Indian climate condition for getting maximum efficiency.
    a. Social media should be utilized in order to reach younger consumer group.
    b. Awareness should be given to women, especially housewives, so that they can reduce their electricity consumption and use solar home pack at least at peak time.

c. Fostering Environmental awareness not only among consumers but also among company employees from top to bottom. Awareness should be given by conducting workshop and seminars to employees working both in the government and private sector. The awareness should be exteneded to supply chain partners for getting better results.

d. Developing National Occupation Standards (NoS) for RE sector would enhance the awareness.

e. Demonstration programmes related to solar energy would help to streamline this technology.

2. Empower and educate consumers about proper caring of the product like topping the batteries with distilled water and cleaning of panels from dust for their improved efficiency.
3. Sometimes, there reduction of electricity bill permanently may not be seen due to the increase in electric equipment and load. Educate customers about social benefit and instead of individual payback.
4. Flexibility of system design must be ensured. Small Wattage system which will cover the peak time period will be beneficial. Instead of 1 KW, market panels after conducting need based assessment of each customer will help to install the required capacity which will be more efficient for all income categories. Tailor made system that suits the needs of buyers appropriately both in terms of affordability and size should be better for its successful commercialization.
5. If the companies prepare their track records of solar installations and make available to public, the limitation for 'observability' can overcome.
6. Enhancement of PWOM could be done through enriching service delivery mechanism which would have an impact on the 'effective' stage of communication. Introducing grievance portal, time bound service, individual care, knowledgeable staff, maintenance, output monitoring and taking responsibility of disposal of panels after its lifetime will make the company competitive.
7. Marketer should enhance the consumer value by focusing QSP (quality+service+price). Customer value is their expectation of perceived monitory value of the bundle of economic, functional and psychological benefits from a market offering. Focus on QSP in order to increase value

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increase in quality and service with decrease in price definitely add value which is the central concept of marketing. Quality, Price and Convenience are the sub drivers of consumer equity. Company can practice Total Quality Method (TQM), Customer Profitability Analysis (CPA), Customer Relationship Management (CRM), Unique Selling Propositions (USP), and Customer Lifetime Value (CLV).

8. Positioning consumers as environmentally responsible and differentiate them by creating unique identity will act as a non-monitory incentive for existing adopters and an impetus for potential adopters.
9. Non-availability of Raw-Material (RM), expense in the manufacturing of solar cells, requirement of special tools and skilled manpower and high end infrastructure are the hurdles which forced India to import solar cells (Energy Next, 2017). Hence, domestic manufacturing is the only way for reducing foreign exchange outflow.
10. Quality control labs and checking mechanism should be organized. The fund for this purpose can be met by charging more, on high peak time electricity consumption.
11. Value equity-customers objective assessment of the utility of an offering is based on its cost-benefit perception. So a product must be need-satisfying. Gradually subsidy removal will lead to a competitive market. At the same time, curtailment behaviour regarding conventional energy must be promoted, such as, reduction of peak time energy consumption and, encouragement of the solar energy through different media.
12. a) Organise seminar/ workshops at least in three months which will be effective in avoiding 'homophily' which acts as an invisible barrier in the diffusion of an idea from a segment with higher socio-economic status.

    b) Mass media channel and cosmopolite channels at knowledge stage interpersonal channel and localite channel for early adopters and persuasion stage.

    c) Celebrity Endorsement.

    d) Ecologically more responsible logistics should be considered by green energy suppliers. Reverse logistic system (consumers will return the used

product to the producers) will be suitable for RTPV in order to create assurance about its recycling.

e) Green emphasis on promotional campaigns with continuous improvement in quality will inculcate a feeling of Willingness to Pay (WTP) among consumers.

13. Introduce Module Insurance, introduction and penetration of Electric Vehicles (EV), encouragement of leasing of rooftop space of home owners, etc. will provide a further impetus for the low carbon technology growth.

14. Enhancement of each dimension of SQ would improve customer satisfaction. Companies can attract customers by offering special services, especially free maintenance, battery water filling, cleaning of panels, help in monitoring the energy savings, updating of information regarding innovative features and related government policies.

15. Product utility can be improved by increasing its energy saving potential, efficient module manufacturing which is suitable to Indian condition which can reduce the degradation effect accompanied by affordable cost.

16. Even though solar energy manufacturing is less hazardous, compared to other conventional sources, special care must be given in the time of manufacturing process of solar panel components. Reengineering and reinventing of more efficient process by using newly developed materials like pervskite which found to be more efficient.

17. Implement 'product stewardship practices' which will enable to minimize the hazard in assessment of solar module/cell manufacturing and can create a positive impact. Relevant product stewardship information should be made available to public. Minimising GHG and CO2 emission is a commendable stewardship aim for green energy business.

18. Keep pollution emission register which provides access to information relating to annual emission of Industries - Web based register will enable the public to view the data on emission

19. When considering barriers faced by the dealers, it should be noted that rural representations were low. Public must be given awareness about the government intervened market and private market. The system integrators are those engaged in additional works, like component manufacturing should be assisted with bank support. Encouragement of domestic manufacturing for cost reduction with insurance facility would help to enhance RTPV market. Awareness regarding off grid, on grid, and hybrid type RTPV and its suitability, RTPV module type and its benefits would help the consumers at the time of selection. Effective utilization of multiple media would be helpful for promoting SPV in all consumer segments. International standards may not be suitable for Indian conditions. It is clear from the literature that the performance varies with geographical conditions. Recently a study argued that rooftop is not suitable for hot climate. The designing of solar modules happening for an average temperature which is prevailing in European countries. However, WISE study established the suitability of SPV more than SWH in Kerala. Further, measures should be taken to develop more efficient modules which are suitable for Indian average temperature.

    As per the new MNRE order, bidding process would help in selecting companies without bias. Similarly, the result would not be satisfactory, if we are giving more focus on target achievement agenda without giving importance to proper maintenance, quality checking and recycling assurance.

7.12 Suggestions to Policy Makers

1. Presently, Transition to RE is becoming compulsory rather than optional. A mandatory environment can be created instead of voluntary environment and make this mandatory environment particularly for houses with an area of above 2500 sq ft , target the consumers with high monthly electricity consumption (>500) which is already mentioned in solar energy policy. Lower Tension (LT) -1A- category who consumes more than 500 KW P/U is subjected to Time of the day (TOD) metering, viz. they have to pay variable rates per unit depending on the time of use. According to latest

tariff revision, they have to pay different rates during normal period, peak hours and off peak hours. Extra charges for peak time usage will benefit for the creation of mandatory environment for High Tension (HT) and Extra High Tension (EHT) consumers for green energy adoption.

2. a) In order to spread awareness, Public must be made aware of externalities of conventional energy, like environmental cost, pollution abatement cost, etc. Before promoting RTPV, inculcating energy conservation behaviour is necessary. Educate customers about basic energy literacy, the quantity of CO2 avoided by solar energy generation.
    b. Activation and strengthening of Environmental Non Governmental Organizations (ENGOs) will further boost awareness among public.
    c. Green energy should be involved in university curriculum and academic weightage for the same should be implemented. Separate center for green energy studies should be established
    d. Awareness campaigns must be conducted through panchayats, municipalities, corporations, schools and colleges. Awareness campaign through local self government will reach middle or lower income segments which will promote them to adopt solar energy at an affordable rate. RE education for kudumbashree members also will help to instill awareness. Promotion through social media, cinema theatres also will be applicable.
    e. Publishing of ambient air quality standards of districts of Kerala will help to build consciousness among people about environmental quality.
    f. Non-domestic installations in schools, colleges, religious institutions, hospitals, industrial and commercial establishments, malls, government establishments, etc. will increase its visibility among public that may increase the belief about the reliability of this technology.
3. Implementation of solar energy in every local self government office to ensure visibility to the public, so that people can observe the plant and its efficient working which will help to develop their trust.
4. It is very disgraceful that even the users are not aware about the reduction in rate provided by State Electricity Regulatory Commission (SERC). The knowledgeable adopters who tried to get the same, unfortunately stepped back

due to the cumbersome procedures. The information regarding incentives should be made more transparent and the knowledge about the same should be imparted to the official state Distributory Companies (DISCOM).

5. Small-size panel production attributed to Special Economic Zone (SEZ) with government support leads to cost reduction due to large scale production, and therefore, people of low income category can have access to this technology. So there should be steps to develop small solar energy systems to those households who need to cover the peak time by RE systems. For that, flexibility should come into the capacity designs of systems which are already fixed in the policies for government programmes and schemes.
6. Promotion of Pico solar energy products will help to familiarize with this technology for non adopters and this also gives a chance for trial of a solar energy product. Accessibility of the same should be ensured.
7. Implement (PAYG) - Pay As You Go Process- Home owner can use the required energy from the system and balance can be fed into the grid.
8. SWH customers are the potential segment for RTPV because of their previous experience with the technology. Furthermore, according to EMC study, 20 lakh houses have inverters, which is a high energy wastage equipment. Inverter users must be encouraged to convert into solar energy. KSEB has already initiated a solar connect programme for shifting the inverters into solar energy.
9. ANERT can act as a change agent. Keep in touch with the existing customers and communicating about their latest updates about solar energy schemes and products and must monitor of randomly selected consumers of RTPV systems. Constitution of an Expert Review Team (ERT) would help in this regard.
10. Promotion of Hybrid system, Implementation of FIT, and Net metering will boost the penetration.
11. Develop rules and Promote BIPV (Building Integrated PV) among contractors which will help further penetration of SPV.
12. Fraudulent distributers with the intention of profit making by exploiting consumers. Implementation of International level standards and specification and communicating the same with consumers will also inculcate confidence. Assure proper quality by-Implementation of international quality standards for technology and certification on installation work done by companies. A

Committee should be set up to keep vigil against the illegal units and frame law to blacklist such companies.

13. Participation and communication must be ensured between all stakeholders in the RTPV market- suppliers, distributors, dealers, EPC, manufacturers, companies including large scale project developers and change agents in Innovation adoption.
14. Through R & Ds, the commercialization of efficient solar cells would lead to cost reduction. Innovations like Bacteria coated with solar energy for more efficient harvesting of solar energy (artificial photosynthesis), developing and commercializing Pervoskite material, kesterite absorber for solar cell production will help to attain more efficiency.
15. a) Implementation of pollution emission registers for checking the emission emitted by heavy commercial and industrial enterprises and fix ELV (Emission Limit Value).

    b) Fixation of ELV or permissible quality for industries and commercial enterprises in Kerala When considering industrial growth, Kerala State Pollution Control Board brought 600 large or medium scale industries and 2500 SSI units under the Air (Prevention and Control of Pollution) Act.

16. Formulation of Micro Enterprise Zone (MEZ) for Solar Energy Developers (SEPs).

7.13 Contribution of research

Many researchers tried to investigate the antecedents and consequences of satisfaction about various customer goods. However an empirical study which integrates all the relevant constructs from important theories definitely add and extend the body literature concerning satisfaction and post purchase behaviour of RTPV adoption which is an important, but neglected area specially in Kerala region.

Validation of comprehensive model for pre and post adoption behaviour of domestic off-grid RTPV will be a substantial contribution to the growing body of literature in this context. Enhancing the understanding of consumer preferences would enable to redesign their product according to the requirements of consumers. The value contributed by this research is that it focuses on consumer behaviour towards

adopting SPV technology through presenting a model incorporating the linkage between SAT, Continued Adoption Intention (CA1) RPB and PWOM. The model is tested with sample of Kerala customers based on actual SPV usage experience. Numerous studies have endeavoured to model the determinants of RET adoption by using most relevant theories TRA, TPB, TAM and DOI.

Here in this research, the researcher tries to connect some key constructs from these models with additional constructs which are based on relevant literature. When we consider the post adoption theories, ECM, TAM, and DOI are extensively used for studying continued adoption intention. Moreover a few studies have simultaneously considered some of the constructs together. However APB, SAT, CAI and Loyalty within a single framework are a first attempt especially in the Kerala context. It will try to answer the influence of these constructs in the real user's context.

The study contributes to the RE adoption literature by empirically validating the relevant constructs included in DOI, TRA, TAM, and TPB theories. Empirical validation using these theories proved that, the constructs used in this theories for predicting actual behaviour intention also found a positive impact, on CAI of the product among the users. Pre and post adoption behaviour of RTPV from these competing theories has not been tried by any of the researcher in Kerala and even at the National level. One contribution of this research is that a majority of the theory constructs were selected by the researcher, actually intended for studying the effects on adoption. Therefore, in this research the effect of these constructs is proved by conducting an empirical model testing in the user's context and it is also proved that these pre adoption factors have an effect on CAI.

7.14 Future Directions for Research

It should be relevant if the factors, such as trust, perceived risk, PN, included in the model to check the effectiveness of loyalty in the RTPV context. Studies on non-domestic consumer's adoption behavior can be undertaken in a voluntary and mandatory environment. A comparative study is also possible. A survey is quite in order with the knowledgeable adopters about their perception. A cost benefits analysis and focus with the marketing barriers are also relevant. Not only cross sectional data but also longitudinal studies are also relevant. After ten years, this study can be repeated in order to measure the changes in consumer satisfaction over time.

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Interview Schedule for Domestic Users of Solar Photovoltaic Rooftop Power Plant in Kerala.

Dear respondent,

This questionnaire is prepared for a Ph.D Research registered with Calicut university, Kozhikode titled "**Green Energy Product Marketing: A Study with Reference to Off-Grid Solar Rooftop Photovoltaic Power Plant (RTPV) in Kerala**",**.** Thank you for taking the time to complete this questionnaire. The purpose of this study is to examine the influencing or motivating factors for adoption of solar energy in Kerala. As a prestigious customer of solar energy product in Kerala, we trust that you have insightful information to share. We will be grateful if you could spare some of your valuable time to fill this questionnaire. Your views are very important for us. The knowledge gained from this study will contribute to the development of solar energy products market that meet the needs of all segments of consumers. It is very important that you answer every item on the questionnaire. Answers given by you will be kept confidential and data will be used for academic purposes only. Thank you for taking the time to complete this questionnaire.

susmithabimsy@gmail.com

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Please note:

1) There are no correct answers to the questions. We are only interested in knowing your opinion.
2) Instructions and scales are provided at the top of each question. Please read carefully before answering the question.
3) Some items may appear to be similar, but they address different issues. Please respond to all items.
4) Lastly, I value your opinions and respect your privacy. I hereby promise that no information about your name or identification will be directly used in the research or for any other purpose.

1) Please assign your opinion on a 5 point scale, how much you are aware of solar energy products: (5 -Highly Aware, 4 -Aware, 3-Not much Aware, 2-Not at all aware, 1-No opinion)

Sl. No.	Solar Energy Products	5	4	3	2	1
1	Solar PV rooftop power plant					
2	Solar water heater					
3	Solar lantern					
4	Solar home pack					
5	Solar cooker					
6	Solar pump					
7	Solar mobile charger					
8	Solar bag					
9	Solar street light					
10	Solar cap					
11	Solar dryer					

2) Please state your solar product.

1) Solar PV rooftop Power Plant ☐ 2) Solar water heater ☐ 3) Both ☐

3) For how many years, are you using these solar products?

	Name of equipment	Years
1	Solar PV rooftop Power Plant	
2	Solar water heater	

4) Installation done through?

1) Through ANERT ☐ 2) Through KELTRON ☐

3) Through any other PSU ☐ 4) Through MNRE Channel Partners ☐

5) Through PVT dealers/Companies ☐

5) Have you ever used inverter before going in for solar system in order to escape of power cuts?

1) Yes ☐ 2) No ☐

6) In your opinion, which is the most powerful media for getting awareness about solar energy products in detail? (Assign your opinion on a 5 point scale,5=Highly preferred, 4= preferred-, 3=Not much preferred,2 =not at all preferred ,1 =No opinion)

		5	4	3	2	1
1	Print Media					
2	TV advertisement					
3	Friends and relatives					
4	Exhibitions					
5	Solar dealer					
6	Through ANERT awareness campaign					
7	Internet					

7) If you installed rooftop panel, please answer the following: (basic details of the system)

1	Your system installation type	1) off-grid	2) on-grid
2	Metering	1) yes	2) no
3	SPV plant capacity		
4	Monthly Output (from Solar Energy Meter)		
5	Your solar panel manufacturing company		
6	System Integrator		
7	Payback period (If calculated)		
8	Quantity of alternative energy saved (from Solar Energy Meter)		
9	Cost of alternative energy saved (from Solar Energy Meter)		
10	% of electricity bill your system will cover		

8) How do you rate the specific installation ? (Assign your opinion on a 5 point scale, 5=Highly preferred, 4= preferred-,3=Not much preferred,2 =not at all preferred ,1 =No opinion)

	Type of installation	5	4	3	2	1
1	On-grid (without battery)					
2	Off-grid (with battery)					

9) Details of your Average Monthly Electricity Usage:

		Before Installation	After Installation
1	Electricity consumption (monthly)		
2	Electricity Tariff (bill) (monthly)		
3	Electricity consumption per day (In units)		
4	Phase connection		
5	Connected load		
6	Your consumer type (slab)		

10) Cost Details? (SPV=Solar Photovoltaic Rooftop Power Plant).

		SPV
1	How much did you initially invest for this solar energy product?	
2	Maintenance charges per year	

11) Sources of funding for your Solar Power Plant (Please mention the amounts from each source)

	Name of product	Govt. subsidy	Bank loan	Own money	Total
1	Solar PV rooftop				
2	Solar water heater				

12) Influencing factors for selecting the company. (Assign your opinion on a 5 point scale, 5 =Highly preferred, 4= preferred-, 3=Not much preferred, 2 =not at all preferred , 1 =No opinion)

		5	4	3	2	1
1	High quality of the system					
2	Credibility/Goodwill of the company					
3	Brand Image					
4	Reasonable Price					
5	Opinion from friends and relatives					
6	Advertisement					
7	Offering Innovative products and more features					
8	Year of experience					
9	Easy accessibility					
10	Good rapport with the distributor					
11	Offers and discounts					

13) Influencing factors for adoption of solar energy systems. Assign your opinion on a 5 point scale, (5 =Highly aware 4= Aware , 3=Not much aware, 2=Not at all aware, 1=No opinion)

	Awareness oriented aspects/AWA					
		5	4	3	2	1
1	I am aware that SPV power plant is a green energy product					
2	I am aware that SPV is useful in reduction of KSEB electricity					
3	I am aware that electricity cost can be saved by using SPV					
4	I am aware about On-Grid solar system					
5	I am aware that SPV is a sustainable energy saving product					
6	I am aware of changing battery after 5 years of installation at the time of purchase					

7	I am aware about the approximate cost that will be incurred for battery replacement					
8	I am aware that no further charge can be possible if battery charge reached 100 per cent					
9	I am aware about on-grid system will not work during power cut.					
10	I am aware about the existing scheme of minimum 2KW on-grid solar system					
11	I am aware of changing inverter if I want to change the system from off-grid to on-grid					
12	I am aware about capital subsidies for solar system					
13	I am aware of SERC order about exemption of Rs 1 For monthly electricity bill for 1 kw owners					
14	I am aware about installation of a meter from KSEB is necessary for getting SERC reduction					
15	I am aware of net metering facility for on grid system					
16	I am aware about feed in tariff for solar energy and I think it is a better option for Kerala					
17	I am aware of solar energy policy of govt. and mandatory installation of solar for houses having more than 2500sq ft.					
18	I am aware of the procedures for getting grid connection					
19	I am aware of small battery back- up needed for uninterrupted working of my on-grid system during the time of power cut					
20	I am aware of hybrid solar system					

Please assign your opinion on a 5 point scale. How strongly do you agree or disagree with the following statement . (5 =strongly agree, 4= agree, 3=Neither agree nor disagree, 2= disagree, 1=strongly disagree.)

	Economic Factors(Cost)/EF	5	4	3	2	1
21	I have taken the decision of installing solar system by considering Return On Investment (i.e. breakeven period/payback period)					
22	Solar energy systems have less operational cost					
23	My solar system requires minimum maintenance					
24	I think solar energy would be even more competitive if external costs from fossil fuel were taken into account.					
25	I think I am safe from predictable energy costs (inflation rate) for next 25 years.					
26	My solar system will reduce my electricity bill					
27	Adds value to my property					
28	I think solar system is an Affordable technology without subsidy					
29	I would have adopted solar even if there had been no subsidy					
30	Adopted solar because of government Subsidy/Incentives					

	Government initiatives (legal factors) /ATGI	5	4	3	2	1
31	Solar system will become mandatory in future					
32	I adopted solar because govt. has made mandatory installation of solar in various categories of domestic and non-domestic customers					
33	10000 rooftop programme of ANERT was effective					
34	I think joint effort of KSEB and other government agencies is with ANERT to make the solar programme successful					
35	Strict government rules and regulations across the world caused a growth in the preference for solar					
36	“Solar connect” scheme of Government for change to on-grid is a better option					
37	ANERT is effective in conducting awareness programmes relating to Solar energy products					

(Please assign your opinion on a 5 point scale to know whether these factors have influenced your purchasing decision)

	Perceived Usefulness (Utility factors)/PU	5	4	3	2	1
38	To reduce Electricity bill (Effectiveness in cost saving)					
39	Conventional fuel saving					
40	Peak time consumption reduction					
41	Reduction in number of working hours due to power breakdown					
42	We want uninterrupted power supply					
43	Protection against raising trends of fossil fuel energy					

Measurement of environmentl/Suatainability orientataion . Please assign your opinion on a 5 point scale. Whether these factors have influenced your purchasing decision. (5 =strongly agree, 4= agree, 3=Neither agree nor disagree, 2= disagree, 1=strongly disagree.)

	Environmental Attitude/Relative Advantage (EA/RA)	5	4	3	2	1
44	Solar energy will help people to have a better quality of life					
45	To meet expectation for sustainable products					
46	Solar energy helps improving public health by reducing pollution					
47	Solar energy can produce our own clean and safe electricity					
48	Working of the system has silent operation (No noise pollution)					
49	By going solar, we demonstrate our environmental awareness and responsibility					
50	Reduce the impacts on ecosystem caused by the extraction transportation, processing and use of fossil fuels					
51	To be a part of green path of global economic development					
52	Solar energy can reduce green house gas emission					
53	Preventing global warming impacts by changing into solar energy					
54	Reduce carbon footprint					

Buyer Social Responsibility Factors.(5 =strongly agree, 4= agree, 3=Neither agree nor disagree, 2= disagree, 1=strongly disagree.)

	BSR	5	4	3	2	1
55	Solar energy can enhance energy security at global, national and local level					
56	Solar energy can play an important role in eliminate energy poverty					
57	Solar energy is abundant and serves as an unlimited source of energy					
58	Reduces/Eliminates Reliance on Alternate Sources of Energy such as Nuclear Fuel from other countries (Thereby making us dependent on them)					
59	Reduces/Eliminates dependence on Risky sources of Energy Sources such as Nuclear Energy (Eg: Radiation Risk, Explosions Risk etc)					
60	Millennium Development Goals, such as ensure environmental sustainability could be achieved by utilizing solar energy					
61	Savings on expenses of new conventional power plants					
62	Reduced investments in transmission and distribution infrastructure					
63	Reducing rural energy poverty					
64	Solar power is compatible with modern living					
65	Solar system provides a comprehensive solution for hot water and electricity					

Social influences

	Subjective Norms (SN)	5	4	3	2	1
66	Adopted solar by friends encouragements and support					
67	Adopted solar by colleagues' encouragements and support					
68	Adopted solar by families encouragements and support					
69	I adopted solar because I feel proud to say that I can generate my own electricity.					

RPB

		5	4	3	2	1
70	I would consider the use of further solar energy in future					
71	I will definitely change solar system in to on-grid					
72	I am willing to pay for a small battery backup which is needed for uninterrupted working of my on-grid system during the time of power cut					

Measuring Overall Satisfaction

14) Are you satisfied with solar energy system? (please assign your opinion on a 5 point scale ,5 =highly satisfied, 4= satisfied, 3=Neither satisfied nor dissatisfied, 2= dissatisfied, 1=highly dissatisfied.)

Products oriented aspects

		5	4	3	2	1
1	I am satisfied with the quality of panel					
2	I am satisfied with good quality of inverter					
3	I am satisfied with good quality of battery					
4	Present installed capacity is enough for meeting my electricity requirements.					
5	I will get enough electricity for working all my equipment as I expected					
6	Present Battery capacity is enough for my system					

Price oriented aspects

7	My company charged a reasonable price for the system					
8	Monthly Installment system will make this solar system more popular					

(5 =strongly agree, 4= agree, 3=Neither agree nor disagree, 2= disagree, 1=strongly disagree.)

		5	4	3	2	1
9	I find no difficulty in switching over from solar to grid electricity as it is not automatic					
10	I find no difficulty in filling water in battery					
11	I can use my SPVPP without frequent failure after installation					
12	I felt Better Usage experience with SPVPP					

Service oriented aspects (SQ)

(5 =strongly agree, 4= agree, 3=Neither agree nor disagree, 2= disagree, 1=strongly disagree.)

		5	4	3	2	1
13	I got timely installation of the system without any delay					
14	I am satisfied with the installation work done by the company					
15	I felt no delay in getting service whenever I called the company					
16	There is no such situation demanding to call the company after installation for any failure					
17	My company will monitor my system in every 6 months					
18	I am sure about the Credibility of SPVPP providers					
19	I have not incurred any additional expenses, such as labour and material charges for installing the system.					
20	I have an opinion that it will be better if the companies do the maintenance services in every 6 months					
21	My company will take responsibility of reinstallation after 20 years					
22	My company has provided detailed information filling of water in batteries.					
23	My company informed about on grid system					

24	My company insisted on me to clean panels every three months.					
25	I received better customer support from my SPV company					
26	My company is doing enough promotional activities about solar energy system					

Convenience related aspects

27	I am satisfied with accessibility of company in my district					
28	I am satisfied with availability of authorized dealers of the company					
29	I am satisfied with the availability of components/spare parts					
30	I am totally satisfied with SPV (Overall Satisfaction)					

15) Continued Adoption Intention

1	I will try to stick on this technology in future					
2	I have an intention to adopt the related technology in future (Further Capacity Addition)					

16) Positive Word of Mouth

1	I will recommend this product to others					
2	I will say positive things about this product					
3	If somebody asks any kind of recommendation about this product, I will recommend this product					

Socio demographic factors.

16) Your Monthly Income:

1) Below Rs.20000 ☐ 2) Rs. 20000-30000 ☐ 3) Rs. 30000-40000 ☐

4) Rs.40000- 50000 ☐ 5) Rs .50000 above ☐

17) Educational Qualification:

1) Undergraduate ☐ 2) Graduate ☐ 3) PG ☐ 4) Diploma ☐

5) Professional Qualification ☐

18) Occupation:

1) Govt. employee ☐ 2) Business ☐ 3) Private Employee ☐

4) Profession ☐

19) Area : 1) Corporation ☐ 2) Municipality ☐ 3) Panchayat ☐

20) Gender : 1) Male ☐ 2) Female ☐

21) Age : 1) 20-30 ☐ 2) 30-40 ☐ 3) 40-50 ☐ 4) 50 above ☐

22) District :

23) Phone : ----------

24) E-mail : ----------

25) What are your suggestions to government to promote the use of solar equipments?

_____

_____

26) Any suggestions to dealers/companies ?

_____

Interview Schedule for Companies/Dealers

Dear respondent,

This questionnaire is prepared for a Ph. D Research registered with Calicut university, Kozhikode "**Green Energy Product Marketing: A Study with Reference to Off-Grid Solar Rooftop Photovoltaic Power Plant (RTPV) in Kerala**",**.** Thank you for taking the time to complete this questionnaire. The purpose of this study is to examine the marketing problems of solar energy market in Kerala. As a established company/provider of solar energy products and services in Kerala, we trust that you have insightful information to share. We will be grateful if you could spare some of your valuable time to fill this questionnaire. Your views are very important for us. The knowledge gained from this study will contribute to the development of solar energy products market that meet the needs of all segments of consumers. The survey is designed to take a few minutes of your time. It is very important that answer every item on the questionnaire. Answers given by you will be kept confidential and data will be used for academic purposes only. Thank you for taking the time to complete this questionnaire.

Please note:

1. There are no correct answers to the questions. We are only interested in knowing your opinion.
2. Instructions and scales are provided at the top of each question. Please read carefully before answering the question.
3. Some items may appear to be similar, but they address different issues. Please respond to all items.
4. Lastly, I value your opinions and respect your privacy. I hereby promise that no information about your name or identification will be directly used in the research or for any other purpose.

General information.

Name of the company:

_____

Phone:

_____

E mail:

_____

1) Location of the Unit:-

1) Rural ☐ 2) Urban ☐

2) Length of existence of Establishment

1) 1 to 3 years ☐

2) 4 to 6 years ☐

3) 7 to 9 years ☐

4) 10 or more ☐

3) Your nature:-

1) ANERT/ MNRE channel partners ☐

2) Non Channel Partner ☐

4) Type of provider or company:-

1) System integrators ☐

2) Sub contracting Base ☐

2) Component Manufacturer + system integrators ☐

4) Project developers ☐

5) Dealers of MNRE channel partners ☐

5) Solar Products your company is dealing with:-

1) SPV ☐

2) SWH ☐

3) Both ☐

6) In the case of SPV:-

1) On grid ☐

2) Off grid ☐

3) Both ☐

7) Specify the type of SPV Technology you dealt with:

SPV	
Poly chrystalline	
Monochrystalline	
Thin film	

8) Please specify the details of installations of your company in the following table.

	SPV installations in Kerala
Cumulative Installation	(in KW)

9) Your area of operation

1) Regional ☐

2) All over Kerala ☐

3) National level ☐

4) International ☐

10) What kind of promotional efforts do you make?

1) Advertisement in press releases ☐

2) Advertisement in media ☐

3) Through internet ☐

4) Through exhibition ☐

5) Any other means (Please specify) ☐

6) None of the above ☐

11) Do you get support from bank to promote solar equipment?

1) Yes ☐ 2) No ☐

Which are the barriers you face while selling solar equipment? Please assign your opinion on a 5 point scale. How strongly do you agree with following statements. (1=strongly agree, 2= agree, 3=Neither agree nor disagree, 4= disagree, 5=strongly disagree.)

Sl. No		1	2	3	4	5
12	Lack of awareness of consumers					
13	Lack of fund for promotion (Cost of promotion)					
14	Complexity of the product					
15	Credibility of solar technology in the public eyes					
16	Cheap products are flooding in the market					
17	Unable to provide timely after sales service					
18	Inadequate workforce skill and training					
19	Lack of clarity in adequate codes, standards and interconnection and net metering guidelines					
20	Inadequate implementation of policies					
21	Complexity of subsidy administration					
22	High initial cost of solar					
23	Difficuity overcoming established energy systems					
24	Inadequate financing options					
25	Failure to account for all costs and benefits of energy choices					
26	Lack of stakeholder/community participation in energy choices and RE projects					
27	Misplaced incentives					
28	Unscientific fiscal and regulatory policies					
29	Lack of credibility of companies/dealers					
30	Difficult installation due to inaccessibility of location					
31	Does not add value to property					
32	Not understanding the long term importance of solar energy					

33	High payback period for customers					
34	Inadequate installation and service infrastructure					
35	Lack of familiarity with the technology among dealers					
36	Trends in conventional electricity costs.(current status)					
37	Lack of ensuring quality of components.					
38	Lack of communication within industry to identify technical problems					
39	Inconsistent government policy relating to PV					
40	Mismatch between market capability and actual achievement.					
41	Lack of stable renewable energy investment climate vis a vis real estate business					
42	Lack of consumer education					
43	Tardy implementation of Govt. decisions					
44	Lack of equitable net metering guidelines					
45	Lack of community involvement and support					

Number of system installed in SPV market in Kerala

46) Total of on-grid installations	
47) Total of off-grid installations	

48) What support do you need from government to increase sale?

1) Incentive to the component supplier/ Manufacturer

2) Incentive to the buyers

3) Incentive to the system Integrators

49) Do you provide AMC?

1) Yes ☐ 2) No ☐

50) Average number of visits to the customers annually for AMC ?

1) 1 to 3 times ☐

2) 4 to 6 times ☐

3) 7 to 9 times ☐

4) 10 or more ☐

51) What is your suggestion to government about promoting solar equipment?

1) Export duty exemption from manufacturers ☐

2) Customs duty exemption to importers ☐

3) Remove service tax for solar installations ☐

4) Remove VAT and CST for solar products ☐

5) Any Other (Please Specify) ☐

52) What do you think are the strengths and weaknesses of your company in this field? (Rank them according to priority)

	Strengths
Price	
Product quality	
Market knowledge	
Supply chain management	
Networking	
Credibility/Reputation and ack track record	
After sales service	
Others. (Please Specify)	

53) Per cent cost of Indian made components, imported components and labour ?

Components	Per cent of cost
Indian made components	
Imported Components	
Labour	

54) How is your existing customers attitude towards your products ? (1=Highly Satisfied, 2=Satisfied, 3=Neither Satisfied nor Dissatisfied, 4=Dissatisfied, 5= Highly Dissatisfied)

5	4	3	2	1

55) Do you consider customers in rural area in Kerala in your business or sales strategies?

Yes ☐ No ☐

If yes, specify the per cent your company has been doing for customers in rural areas?

56) Does your company provide means of financial means of solar for customers ?

Yes ☐ No ☐

If yes, please specify some of them.

_____

_____

_____

57) Which type of incentives does your company receive from the government ?

Feed in tariff ☐

Tax reduction ☐

Tax exemption ☐

Others, please specify. ☐

58) Which existing scheme of government do you think most beneficial for promotion of solar energy market? (Please specify)

1)10000 roof top programme

2) Solar connect

3) Any other (Please specify)

59) Are you satisfied with Govt schemes ? (1=Highly Satified, 2=Satisfied, 3=Neither Satisfied nor Dissatisfied, 4=Dissatisfied, 5=Highly Dissatisfied)

	1	2	3	4	5
SPV					

60) Could you please name some of your competitors in the market domestically and internationally?

_____

_____

_____

61) Which countries or regions are your suppliers from ?

62) What are your company's future plans to expand the market?

DIRECTORATE OF RESEARCH, UNIVERSITY OF CALICUT

General format for submitting Report on Peer-reviewed Research Publication (latest first)

Sl. No.	Authors in order and Title of Publication*	Journal Name, Volume, Number, Year & Digital Object Identifier (DOI) Number	Inter-national/ National**	Publisher with ISSN	Web Address of the Journal	Indexed by ***	Impact factor if any
1	Susmitha Mohan M[1]& Dr. Philo Francis[2]. ***Environmental Attitude And Perceived Innovation On The Purchase Intention Of Solar Photovoltaic Rooftop Power Plant: An Exploration*** **July 2016**	**Ahead – International Journal Of Recent Research Review (AIJRRR)** Vol.1, Issue.29, Nov 2016.	International	SLAA Publications E- ISSN - 2349-6746 Online ISSN: 2456 – 205X	http://www.aijrrr.com	SJIF ROAD	5.002
2	Susmitha Mohan M[1]& Dr. Philo Francis[2]. ***Role Of Government For Solar Energy Products Market Promotion With Special Reference To Solar Photovoltaic,*** **October 2015**	**International Journal Of Management Sciences** Vol.6, Issue.3, June -August 2016,	International	Research Academy of Social Sciences 2310-2829 Online ISSN: 2310-2845	http://www.rassweb.com	INDEX COPERNICUS GIF (Global Impact Factor) URL/CHS WEB-Global Serial Directory Proquest Journal Seeker Research Bible SSRN DOAJ –Directory of Open Access Jounals Google Scholar Academic Journals	4.136

						Database DRJI- Directory of Research Journal Indexing PDOAJ:Pak Directory of Open Access Journals ICI World of Journals ICI Journals Master list Universitats Rosenburg UNIVERSITATSBIBLOTHEK LEIPZIG Regional Information Center for Science and Technology	
3	Susmitha Mohan M[1]& Dr. Philo Francis[2] ***Solar Energy - A Way for Empowering the Nation.(3)***	**International Journal of Multidisciplinary Research Review**	International	SLAA Publication E-ISSN 2395-1885 ISSN 2395-1877	http://www.ijmdrr.com	Google Scholar DOAJ –Directory of Open ACCESS journals DRJI DAIJ International Innovative Journal OAJI –Open Academic Journal	5.389

				Impact Factor (IIJIF) OAJI –Open Academic Journal Index.net Turnitin Thomson Routers Zenodo	

*The applicant should be the first author or the corresponding author; review papers may not be entertained.
**Preference may be given to International Journals.
***Agency which popularises the publication, e.g., google scholar, scopus, etc.

Specific Remark/recommendation of the Chairperson, PGBS/Head of the Research Centre, based on the above criteria:

As per the Rules and Regulations for Research leading to Ph.D-2012, it has been verified that the research scholar has published *Five research papers* in *Peer Reviewed National/ International Journals* in *the approved area of her research*, before the date of submission of her thesis to the University. All the publications mentioned above are *research papers* and not review papers; with *the applicant as the first author*.

Signature with date:

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Name & Designation:

Chairperson &

Head of the Research Centre

St. Joseph's College Autonomous,

Irinjalakuda, Thrissur, Kerala.

Presentations in Seminar / Conference

Sl No.	Title of The Conference / Seminar	Title of The paper	Place	Date
1.	Proceedings of National Conference on Consumer Behavior	*A Study about the Attitude and Barriers towards Penetration of Solar Water Heater in Kerala: A Non Adopters View.(1)*	SDMIMD, Mysuru	30th October 2015
2.	UGC sponsored national seminar on Research Methodology and Statistical Analysis using SPSS.	*Measuring Concern for Environment among Customers of FMCG Products.*	St. Joseph's College, Irinjalakuda, Thrissur	July 30,31 and August 1, 2015
3.	National workshop on "Basics of Modern Research"	*Green Marketing: A Way for Sustainable Development.*	St.Joseph's College, Irinjalakuda.	22nd March 2014
4.	National Conference on Green Business-Emerging Trends, Opportunities and Challenges	*Impact of Green Marketi on Global Business.*	Christ College, Irinjalakuda	3rd Dec: 2013
5.	National Conference on Consumer Behavior: Contemporary Issues and Emerging Trends	*A Study about the Attitude and Barriers towards penetration of Solar Water Heater in Kerala: A Non Adopters View. (1)*	SDMIMD, Shri Dharmasthala Manjunatheshwara Institute for Management Development, Mysore, Karnataka.	30th October 2015
6.	Two day National Semina on Emerging Trends in Infrastructure Developme Concepts, Challenges and Promises	*Infrastructural Development- the Challenges and Opportunities in the Indian Power Sector.*	Panampilly Memorial Government College	5th and 6th Feb:2013