A Major Project Report

On

<u>CONSUMER PERCEPTION TOWARD SOLAR</u> <u>POWER PRODUCTS</u>

Submitted for the award of the degree of Executive MBA

By

Imran Khan DTU/2K13/EMBA/506

Under the Supervision of:

Dr. Rajan Yadav

Associate Professor, DTU



Delhi School of Management Delhi Technological University May, 2015

DECLARATION

I hereby declare that the Project report titled "<u>Consumer Perception toward Solar</u> <u>Power Products</u>" is my original work and has not been published or submitted for any degree, diploma or other similar titles elsewhere. This has been undertaken for the purpose of award of the degree of Executive MBA at Delhi School of Management, Delhi Technology University.

Signature of Student

(Imran Khan)

Place : Delhi Date : 20.05.2015

CERTIFICATE

This is to certify that the project entitled "<u>Consumer Perception toward Solar</u> <u>Power Products</u>" is the bonafide work carried out by Imran Khan, student of Executive MBA, Delhi School of Management, Delhi Technological University, during the year 2015, in partial fulfillment of the requirements for the award of the Degree of Master of Business Administration and that the project has not formed the basis for the award previously of any degree, diploma, associate ship, fellowship or any other similar title.

Signature of Guide

(Dr. Rajan Yadav) Place : Delhi Date : 20.05.2015

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"It is not possible to prepare a project without the assistance & encouragement of other people. This one is certainly no exception."

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Imran Khan

MBA (2013-2015)

Delhi School of Management

Delhi Technological University

ABSTRACT

In the project I considered most common factors influencing the consumers buying behavior on solar energy products. It includes factors that make consumers to buy particular solar energy products. The factors describe pre-purchase and post-purchase behavior.

The methodology adopted was descriptive research. Descriptive research is done using factor analysis by using a statistical tool called SPSS. A standard and structured questionnaire was prepared and used during the interviews as a tool for research to find the level of importance of each factor. The response of common people was collected. They were asked to rate the factors on a Likert five point scale in agreement with the statements and scale ranges from 1= Strongly Disagree to 5 = Strongly Agree. A total of 78 samples were collected in a period of two months.

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Industry Profile:

Since Independence, the Indian Power Industry has continuously faced the issues with meeting its power generation goals. The conventional energy sources especially coal hasn't been able to meet the demand and the country needs a true approach to meet its ever increasing energy demand.

Solar energy, a clean source of renewable energy which emits zero carbon, has got a remarkable potential of the energy which can be harnessed using several types of devices. Solar power industry has gain a pace in its development and its systems are now available for commercial as well as domestic use with enhanced advantages at minimal cost of maintenance. Usage of Solar Power systems or devices has become financially viable with various government initiated tax incentives, subsidy schemes and rebates. Now a days, solar energy is getting more and more popular in developing and developed nations. In developing nations, it is on early adoption stage whereas in developed nations, most of them are trying to switchover to renewable energy sources completely.

The world's population is growing continuously and hence increases in the demand of water, food and energy which in turn affecting environment. The world's population has become more than double from 3.2 billion since 1962 to 7.2 billion in 2015 and it has been forecasted to grow up to 9.2 billion by 2050. Resources or reserves of coal, gas, oil and uranium are depleting day by day. The frequent usage of these non-renewable resources have put pressure on the energy sector to move away from carbon emitting processes to solar, nuclear and other environmentally friendly options.

("<u>United Nations Department of Economic and Social Affairs</u> Survey, 2012") <u>World Energy Scenario</u>

"According to the 2007 BP Statistical Energy Survey", in 2006 world's electricity generation was 19,028 terawatt-hours (TWh). The nations who were generating the most electricity are the USA, China, Japan, Russia, India, Germany, Canada and France. The demand of electricity of the World in 2006 was 15,000 TWh and is forecasted to be 30,000 TWh in 2030.

In 2004, there were 16% of Nuclear and 18% of Hydro and rest from fossil fuels which make the world's electricity mixture. According to the IEA (2006), the main sources of electricity produced worldwide were coal (39.8%), gas (19.6%), hydro (16.3%), nuclear (15.8%), oil (6.7%) and other renewable (1.8%). As compare to other fuel options, the contribution of cal has been growing at a rapid rate in recent years. In recent years, there has been a transformed interest towards nuclear than hydro. As of March 2007, in comparison to Africa who was using hydro potential mere 5%, Asia was using 40% and Europe was at 80%.

Indian Energy Scenario

India, being a tropical country, has a very vast potential for Solar industry where approximately 45% of rural households do not have access to electricity.

Today India's population is nearly 1.25 billion and currently facing a huge energy demand. In the production and consumption of electricity, India ranked fifth in the world. The production of electricity has been increased during the last few years at an increasing rate equating to the population expansion rate of the country. The electricity produced by India is mostly from coal (53%) and it is forecasted that coal reserves in the country will last up to 2050. In India, more than 72% population resides in villages and more than a half of the villages have not been electrified and remains without electricity. To meet this ever increasing demand, solar energy is the best solution to cater the energy needs and bridge the demand supply gap.



Fig. 1 "Demand Supply gap of power in India from XI to XI five year plans"

India, being located between the Tropic of Cancer and the Equator, is solar energy resources rich country. The average temperature ranges from 24° C – 28° C and receives 4–7 kWh of solar radiations per sq. meter which means more than 5,000 trillion kWh radiations throughout the year leads to approximately 300 sunshine days. States like Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Andhra Pradesh, Orissa, West Bengal, Haryana and Punjab have huge prospective to harness solar energy as these states are located near to the tropic of cancer and the equator. Also the majority of population resides in rural areas and there is a huge potential for solar energy to be promoted. Solar energy can help to reduce the usage of firewood and dung cakes which emits the carbon and carbide.

India is slowly gaining its fame in the harnessing of the solar energy due to various ambitious and comprehensive state and centre driven solar policies and projects under the National Solar Mission. As per the 2014-15 budget, Finance Minister has already declared an aid of rupees 500 Crore to develop some mega watt solar power plants in Tamil Nadu, Rajasthan, Gujarat, Leh & Laddakh. He also announced to develop solar powered agricultural water pumping stations and 1 MW solar parks on the canal banks at the estimated cost of \$ 74 million and \$ 18.5 million respectively.

According to BRIDGE TO INDIA and GTM research report, India is facing a perfect storm of factors that will boost solar photovoltaic adoption at a rapid pace in coming years. The day by day falling price of SPV cells being imported from the U.S. and China has equated with the growing cost of grid generated power in India. Being a developing country is facing a huge electricity shortage which often runs 10% to 13% of daily requirement.

Indian solar industry has an immense potential to grow at a rapid pace. It is believed that in future, most of all the gadgets will be powered with solar energy rechargeable battery bank. The huge usage of non-renewable energy resources results in depletion of these fuels, day by day increasing electricity demand and increasing awareness about renewable energy sources have encouraged people to adopt such technologies which can harness the abundantly available solar energy. Various Renewable energy technologies for domestic use

- Photovoltaic's (PV) is a process of generating electrical power by converting solar radiation (Photon energy) into direct current electricity using semiconductors which exhibits the photovoltaic effect. To generate photovoltaic energy, solar panels are used which are manufactured with the help of numerous solar cells connected in a series and parallel combination. Materials used to produce photovoltaic cells include crystalline silicon, amorphous silicon, cadmium telluride and copper indium gallium selenide/sulphide.
- Solar thermal energy (STE) is a technology which is used to harness solar energy to get thermal energy (heat). Solar thermal collectors are classified by the United States Energy Information Administration (USEIA) as Lowtemperature collectors are flat plates generally used to heat swimming pools; Medium-temperature collectors are usually flat plates and used for heating the water or air for residential and commercial use and High-temperature collectors ponder sunlight using mirrors or lenses and are generally used for electric power production.
- **Biogas** typically refers to a gas produced by the biological breakdown of organic material in the deficiency of oxygen. Organic dissipate such as dead plant and animal substance, animal manure and kitchen waste can be converted into a gaseous fuel called biogas.
- Smokeless Chulah is the superior versions of the conservative chulah and has higher consumption of heat and a design which has a chimney to make a passage for the fumes thus making the cooking relatively smoke free.
- **Pellet stove** is a stove that burns dense wood or biomass pills to create a source of heat for residential and commercial spaces. By slowly injecting fuel from a storage box into a burn-pot area, they create a stable flame which does not require any physical adjustments.

Now a days, the demand in India for solar powered products has been raised very significantly and expected to grow more at a rapid rate. In Indian market, there are many products which are available and a few of them are as follows:

- Solar Portable Lanterns,
- Solar Home Lighting Systems,
- Solar Street Lighting Systems,
- Solar Power Packs,
- Solar Powered Mobiles,
- Solar Chargers,
- Solar Shavers,

- Solar Candles,
- Solar Night Lamps,
- Solar headphones,
- Solar Fans,
- Solar Heaters,
- Solar Power Plants,
- Solar Torches,





Fig. 2 "Solar Power Products"

Today, India being world's 3rd largest economy, the economy has risen gradually over the last 30 years. Since 2000, it has grown at a rate of 7% averaged annually. Demand in electricity has grown at a rate of 10% annually which is similar to the growth rate of the economy. According to a survey, there will be a 92 GW electricity demand over the next 10 years.

The Government of India and its state governments have created a major initiative called 'The National Solar Mission' (refer to fig. 3). The main feature of the mission is to make India a global leader in solar energy sector and the mission has envisages a target to install solar generation capacity of 20 GW by 2022.



Fig. 3 "National Solar Mission Plan"

To put a thrust to the National Solar Mission Plan, government has been made a mandate to install and use solar powered equipments at all government buildings, hospitals and hotels. The government has significantly expanded its solar plans to achieve 100 GW of solar capacity with a target investment of US\$ 100 billion. By the end of February 2015, the energy sector has generated 961.77 BU (during April, 2014 to February, 2015) whereas the installed capacity was 261.05 GW. The overall generation capacity of the energy sector is about 1103 TWh out of which mere 13% to 15% is being generated through renewable energy sources.

The daily power outages on an average for commercial as well as for domestic are of 5 to 10 hours which includes planned and unplanned outages. In India, more than 40% of electricity is being stolen which in turn makes the losses to the electricity producers and to minimize these losses, they charges more money from the genuinely paying customers. Today, Solar based energy is contributing mere 0.5% only with a grid-interactive solar power totaling to 2.12 MW from 33 such installations. Over the next ten years, the Indian GDP is targeted to increase at 8%. By 2017, the power demand may rise to 315-335 GW from 120 GW in 2015.

(http://www.indianmirror.com/indian-industries/solar.html)

Factors that Drives the Indian Solar Energy sector

The two major factors that drive the current and future growth of the Indian solar energy sector are Demand side growth drivers and supply side growth factors.

• Demand side growth factors

India is suffering continuously a shortage of supply to meet the demand with an average demand-supply gap of 12% of total power supply. The demandsupply gap is just because of increase in the need which plays a major role for the growth of this sector. The Power Ministry has forecasted an increase from current demand of 660 KWh to 1900 KWh by 2032. The policies such as JNNSM which is aimed to support investment in the solar energy sector which in turn help to develop a market for solar energy and driving the costs down. An increasing public awareness associated with fossil fuel such as energy scarcity and environmental preservation also propel the demand for ecofriendly energy which leads the growth opportunity for the solar power sector.

• Supply side growth factors

Today, the current power generation is dependent a lot on non-renewable natural resources such as petroleum and coal which are depleting day by day and this has forced the government and the power generating companies to gaze on renewable energy resources especially solar power. The constructive atmosphere formed by government through various subsidy schemes and policies has encouraged power generation companies to invest in this sector and therefore endorsing the growth.



Fig. 5 "Drivers of demand and supply and major challenges"

Challenges Faced by Indian Solar Energy Sector

The Indian solar industry is still in its promising stage and facing many challenges such as lofty cost for the production of solar power. The cost of solar electricity production is Rs. 16.54/unit. The production is carried out by several components and out of which solar cells are imported (nearly 80%) from other countries. This import attracts high duties, levies and custom duties which in turn lead to increase in the cost of overall system. The solar projects are capital intensive and due to lack of an effective financing schemes and policies hamper the growth in the sector. Inequality in solar potential across states is another major challenge which is evident from the irradiance map given below.



Fig. 6 "Irradiance Map of India"

Currently in the solar energy sector, research and development is still in its initial stage and have not attain a pace due lack of collaborative and goal driven efforts. For exploitation of solar energy in India, technological improvements are required by which the efficiency of current solar energy devices can be improved. To facilitate this, government has to support full R&D schemes and provide inducements along with the current subsidy schemes.

The key reason for the restricting the growth of this sector is lack of standards which results the fragmentation of the market among suppliers and manufacturers. Standardization of the specifications and systems will validate the cost being incurred by the manufacturers as R&D and newer technologies to meet common specifications. Currently the solar industry facing the main challenges is to increase consumer awareness about the benefits and also the industry-government cooperation to boost the industry.

Government Initiatives and Schemes for the Development of Solar Energy sector

In 1992, India got its first exclusive ministry for renewable energy development which was named as Ministry of Non Conventional Energy Sources (MNES). Since Oct, 2006 it is known as Ministry of New and Renewable Energy (MNRE) which helps to boost the renewable energy sector by various schemes.

• National Action Plan on Climate Change (NAPCC) inducts a government policy which has mandated a percentage of electricity to be generated through renewable energy resources. "(NAPCC envisages renewable energy to constitute approximate 15% of the energy mix till 2020)"

(http://indiapowersector.com/home/tag/napcc)

- On the 11th January, 2010, Jawaharlal Nehru National Solar Mission (JNNSM) was launched by Dr. Manmohan Singh (former Prime Minister, India) and set the ambitious target to install 20,000 MW of grid connected solar power by 2022 to reduce the cost of power generation through solar power with the help of followings:
 - Long term policy
 - Large scale deployment goals
 - o Aggressive R&D and
 - Domestic production of critical raw materials, components and products.

(http://www.mnre.gov.in/solar-mission/jnnsm/introduction)

- For the promotion of Solar Energy, various subsidy schemes launched under JNNSM:
 - ✓ 30% subsidy is given by central government for home solar power plants and AP Govt. to offer 20% extra subsidy for solar units.
 - ✓ National Bank for Agriculture and Rural Development (NABARD) is giving 50% loan for solar unit's installations.
 - ✓ For households below the poverty line, 100% capital subsidy would be provided as per norms of the Kutir Jyoti Program.

(http://www.mnre.gov.in/solar-mission/jnnsm/introduction)

- There are some incentives on energy generation from grid interactive solar power projects (Thermal and SPV both).
- Subsidy schemes on accelerated development and deployment of solar water heating systems under the JNNSM.
- Promotion of Solar Thermal Systems for air heating/Steam generating applications, Solar buildings and Akshay Urja Shops.
- Setting up 1,000 MW of Grid-Connected Solar PV Power Projects by Central Public Sector Undertakings (CPSUs) with Viability Gap Funding (VGF) under Batch-V of Phase-II of JNNSM.
- A set target of 400 megawatt biomass power projects for the 12th plan period and 100 megawatt during the current financial year.

(http://www.mnre.gov.in/solar-mission/jnnsm/introduction)

Investment Opportunities

There is tremendous scope for the investment in solar energy sector and government of India has started to consider all possible measures to promote this sector in the country. The initiative of various policy and incentives schemes has already been launched by government and coming up with new policies time to time as per the requirement of the industry to boost it. A few of investment opportunities are as follows:

- Joint Venture: a number of companies are entering in this sector as a joint venture with leading PV manufacturers. As there is no set condition specified by MNRE for the formation of joint ventures, a general condition which is already existing and specified by Ministry of Industry, Secretariat for Industrial approvals and reserve bank of India is applicable for this sector too.
- **Export Oriented Units (EOU):** It is possible to set up a plant as a 100 percent Export Oriented Unit. As, Export Oriented Units are permitted to import raw materials and components duty-free and also they are eligible to sell up to 20 percent of their production in domestic markets.
- **Technology Development:** The government of India (central or state), research organizations, autonomous societies, universities, IITs and industries (with suitable set-up for R&D) are supporting research and development projects.

Top 10 Solar Giants In India

Some of the top players in the solar industry are Central Electronics, Emmvee Solar Systems, Jupiter Solar Power, Lanco Solar, Mahindra Solar One, Moser Baer Solar, Reliance Industries Ltd-Solar Group, Jakson, Tata Power Solar Systems and Vikram Solar.

Organization Profile

Vikram Solar is an internationally acclaimed organization which specializes in manufacturing of SPV Modules. It is a subsidiary of Vikram group of companies, boasting of a glorious history of over 40 years in engineering and manufacturing activities and H.Q. in Kolkata. They owned one of the most technologically advanced SPV module manufacturing facilities in India and they have ISO 9001-2008 accredited manufacturing plant, locate in the special economic zone (SEZ) of Falta, West Bengal, which is spread over a sprawling 45,000 sq. ft. area and boasts of a 150MW installed production capacity. They have a pan India presence as well as a global presence with offices in Europe and Africa. Having built a strong foundation in the sustainable energy market and being one of the front-runners among leading solar PV module manufacturers, Vikram Solar has not only fostered innovation but has built trust, honesty and social responsibility

Vision

At Vikram Solar, we have put together all the fundamental qualities – innovation, technology and skill in perfect coordination with management, experience, and analysis to transfer this vision into reality. Customer satisfaction is paramount to our success ever since our inception, as we continue with our rich legacy to achieve greater feats in the near future.

Mission

At Vikram Solar, we combine technological acumen with managerial skill and forge experience with innovation, analysis and judgment to provide optimum value to our global customers.

Products

- 1. Solar Panels
- 2. Solar Charger
- 3. Solar Heaters
- 4. Solar Lights
 - Solar Street Lights
 - Solar Led Lamps
- 5. Solar Power Plants

Objective of the Study

- 1. To identify and asses the factors affecting the customer's buying decision for renewable energy technologies products for domestic use.
- 2. To evaluate and analyze the factors inhibiting the marketing of New and renewable energy technologies products for domestic use.
- 3. To critically evaluate the policy initiatives of the government for the adoption and diffusion of New Renewable energy products for domestic use.

<u>CHAPTER – II</u>

LITERATURE REVIEW

Literature Review

Marketing Environment

Vernon (1996) in his theory of product life cycle has identified products in the introduction stage as those products which have lower demand and higher cost of production. In other words, these are those products which have just entered in the market. Renewable Energy Technological (RET) products like the solar water heater have been in the market for more a hundred years as reported by the California Energy Centre. But still the use of this vast resource has been by a very few or the technology has not been adopted as widely as it should have been. However, there are also numerous examples to make the case for REP (Renewable Energy Product) strong with potential for widespread adoption. As reported by The Rural Energy Foundation, Netherlands, (2010) the rural energy Foundation programme in the sub-Saharan African Solar Now programme which has identified retailers and distributors for Solar Energy Technology since 2007 and provided training in Technology, marketing, sales and business administration etc. This has now given access to 3 Lac people in just three years. A similar experience has been executed by Sun Lab BOB which is based in Lao which provides affordable, reliable solar electricity to rural household through rental services as reported in an article 'Lighting Up Rural Lao'(2007) in Appropriate technology. Mbogo (2001) states that approximately 2 billion people living in developing countries have limited access to modern energy supplies which makes them dependant on kerosene for lighting and also to spend substantial amount on other sources of energy. He argues that solar lanterns produced by organizations which can withstand the harshness of environment and also be accessible to the target customers by way of financing schemes have great prospective. The acceptance of solar energy products in a society is not just affected by the presence of suppliers of solar energy products but also as concluded by Zahran et.al (2008) on others as environment, socio-economic and political factors have a greater role in the acceptance of solar energy products. Some of the scientists have an opinion that renewable energy technology is still beyond the reach of common man and the support infrastructure like massive electricity storage systems are a deterrent to the widespread adoption as argued by Lee and Gushee (2009). Though by the use of renewable technology and specialized electricity generation and distribution has been a relatively non-viable option at commercial level but at the domestic level and in the rural areas of developing countries like Bangladesh and India approximately 1,65,000 people have been benefitted by approximately 25,000 solar home systems which light up their basic energy equipments (Approximate Technology 2006). Efforts are being made to make RET products affordable for the household consumption.

Consumer Behaviour

According to Schiffman and Kanuk (2007), suggested the below model for consumer decision making, which consider the relations between personal factors and external influences which pals an important role when a consumer makes a purchasing decision. With the help of this model, Murphy et. Al (2008) finds a steady trend among interests, perception and concerns for environment friendly products.



Fig. 7 "Consumer Decision Making Model"

There are varied expectations of consumers of different products from marketers, those interested in health and wellness expect more value for money, more efficient and in-turn the marketers must adopt measures like - combining environmental and economical sustainability as the purchase intent is more in personal lifestyle products. The green claim should be reinforced and support adequately at the retail level. Fairer & Neame (2006) observed that in the United Kingdom the policy for inspiring the market has not resulted in widespread adoption of RET (Renewable Energy Technology) products. However the early adopter and majority have shown a positive perception for the environmental factors, the limiting factors for adoption are financial, economic and aesthetic description. A contrary observation has been done by Bang, Elinger, Hadjimarcou & Traichal (2000) wherein using the reasoned theory approach for their study in the United States they concluded that there exists a positive relationship between belief about salient consequences and attitudes towards paying more for renewable energy. They have also observed that though the concern level was high but the knowledge level for the renewable energy was relatively low and therefore suggest that information based campaigns could be a solution to improve the cognition and in turn lead to stronger belief about salient consequences of using renewable energy.

In the Indian context Mavuri (2011) has observed that the consumer buying behaviour for solar products is a typical experience as the attributes that drive to purchase solar products are slightly different as that of usual products and education and income has a large impact on awareness of the customers about the solar energy products. Also, there is a need for creating confidence in the consumers of solar products by the producers about addressing the problems of usage and after sales services to avoid the effect of negative word of mouth from the current consumers on future (potential) demand. The Indian consumers are still price sensitive which is also observed by Vagela (1993) who concludes that people who are educated and have high income are aware of Solar Products. As observed that family and friends being the strong influencing factors in buying decision, since word-of-mouth a important medium of communication and therefore the role of opinion leaders is of great importance in decision making. The other aspects important from consumer point of view for solar products are aesthetic look of the product, cost, sturdiness, awareness, availability, after sales service and number of service centre.

The **Technology Acceptance Model** Davis (1989) explains how users come to accept and use a technology. The model suggests when prospective users encounter a new technology, a number of factors influence their decision about how and when they will use it, notably:



Fig. 8 "Technology Acceptance Model"

- **Perceived usefulness** (PU) is "the degree to which a person believes that using a particular system would enhance his or her job performance".
- **Perceived ease-of-use** (EU) -is "the degree to which a person believes that using a particular system would be free from effort".

Krishnaswamy (2006) concluded that in the Indian context large number customers failed to understand the need of the product, some of them were content with their existing product and for some price remains to be point of concern while consider to adopt a new technology majority:

- Q1: Why are the Indian consumers not adopting New and Renewable energy products?
- H1: Indian consumers are not adopting the RET products due to low awareness.
- H2: Indian consumers are not adopting the RET products due to lack of motivation.
- H3: Indian consumers are not adopting the RET products due to incorrect perception of the products

Marketing Strategy

The product specific features have a great role in the inducement of adoption of renewable energy products. Researchers (Caird & Roy 2008: Smith. K 2009) have observed that products which have greater usability, higher functional efficiency and certain level of customization have higher acceptance in the society. The other factors which have been identified to boost the market performance are improvement in value equation, reinforcement of reliability, reduction in complexity, communication of correct message and exploration of new markets (Milford, J. & Blais, M.(2009)).

Pricing of the renewable energy products still remains a challenge even in the developed economies like United Kingdom where consumers have shown greater interest in lesser priced energy efficiency products (Caird, S. & Roy, R. 2008), even in the developing countries like India, price becomes a major deterrent for those who have low income levels to adopt such products (Mavuri, S. 2011; Vaghela, 1993)

The present generation consumers are environment friendly and they do pay attention to the company's reputation and advertising argues Smith (2009). It has also been observed by Davis (1993) that various mediums like billboard ads, radio ads and ads in print media have been there to connect the product awareness to environment friendliness however still there are lesser ads to promote the economic viability of these products.

- Q2: Why have the marketers of New and renewable energy products not been able to create widespread diffusion of the technology?
- H4: The marketers of the New and Renewable energy products are not targeting the right consumers.
- H5: The Marketing Mix strategy is not appropriate as per target audience.

Policy Initiatives for promotion

The strategic plan for New and Renewable Energy Sector for the period 2011-2017 published by the Ministry of Renewable energy, Government of India (2007) and a report published by ICLEI (2007) have observed the various new features and

initiatives for the renewable energy. Targeting a 10% share of renewable energy production India plans to produce 10,000 MW of power generation by 2012. These policies also support FDI which include provisions for fiscal and incentives for renewable energy programs. A proposal is also given for 100% equity participation in joint venture under this foreign investment policy. Investment under automatic route is also permitted by reserve bank of India. Foreign investment board is also set up to help foreign investors. It is a single window agency which promotes FDI in renewable energy technology in India. Ministry of commerce and industry made industrial policy under which Ministry of Energy Sources promoting medium, small, mini and micro enterprises for manufacturing various types of renewable energy systems and devices. A five year tax holiday is allowed for renewable energy power generation projects. Imports of power projects are allowed and exemption in state sales tax policies for smaller scale industries. The Indian Renewable Energy Development Agency (IREDA) has been set up under Ministry for New & Renewable Energy (MNRE) and is a specialized financing agency to promote and finance renewable energy projects.

Following is a short list of new measures:

- Income tax breaks,
- Accelerated depreciation,
- Custom duty/duty free import concessions,
- Capital/Interest subsidy,
- Incentives for preparation of Detailed Project Reports (DPR) and feasibility reports.

More details regarding other policies are as follows:

- 100 percent income tax exemption for any continuous block of power for 10 years in the first 15 years of operations,
- Accelerated 100-percent depreciation on specified renewable energy-based devices or projects,
- Accelerated depreciation of 80 percent in the first year of operations,
- Interest rate subsidies to promote commercialization of new technology,
- Lower customs and excise duties for specified equipment.

<u>CHAPTER – III</u>

RESEARCH METHODOLOGY

Research Objective

The objective of the study was to identify the most common factors influencing the consumers buying behaviour to purchase solar power products.

Importance of Study

The study was conducted to identify the various internal and external factors influencing the consumers buying behaviour and correspondingly changes can be suggested in the marketing approach of New and Renewable energy products so that New and Renewable energy products can reach to the masses.

Scope of the Study

The study was conducted in the urban and rural areas of Delhi and NCR, a geographic area having conduced climatic conditions for New and Renewable Energy technology products as observed by Bhargav & Gupta (2007) and the power situation marked with regular power cuts, offers an appropriate location for the study.

Research Design

Research design is the plan/strategy/structure of investigation envisaged sp as to obtain answer to the research problem and to control the variance.

The research design can be the following types:

- **Exploratory:** It is conducted to have a better understanding of a situation. It is not designed to come up with the final answer or decision. With the help of exploratory research, researchers expect to develop hypotheses about the situation.
- **Descriptive:** It is used to achieve a wide variety of research objectives. The descriptive data become more useful for solving problems when the process is guided by one or more specific research problems. It requires a clear

specifications of what, who, where, when, why and how of the research problem.

• **Causal:** It is used when researchers requires stronger evidence that a particular action is likely to produce a particular outcome.

Initially the research design was exploratory till identification of parameters later it becomes descriptive when it comes to evaluating common factors influencing the consumers buying behaviour.

Although the data description is factual, accurate and systematic, the research cannot describe what caused a situation. Thus, descriptive research cannot be used to create a causal relationship, where one variable affects another. In other words, descriptive research can be said to have a low requirement for internal validity.

The description is used for frequencies, averages and other statistical calculations. Often the best approach, prior to writing descriptive research, is to conduct a survey investigation. Qualitative research often has the aim of description and researchers may follow-up with examinations of why the observations exist and what the implications of the findings are.

Research Sample

Sampling Plan

Since it is not possible to study whole universe, it becomes necessary to take sample from the universe to know about its characteristics.

\triangleright	Sampling Units	:	Residents of Delhi & NCR.
\triangleright	Sampling Size	:	78 respondents.
\triangleright	Sampling Technique	:	Convenient Sampling.
\triangleright	Research Instrument	:	Structured Questionnaire.
\triangleright	Contact Method	:	E-mail and Online availability.

<u>CHAPTER – IV</u>

DATA ANALYSIS

Data Collection Sources

Primary Data:

The primary data was collected by means of a survey. Questionnaire was prepared and floated online to fill up the questionnaire. The questionnaire was designed with 28 questions keeping in view all those possible factors which can influence the consumers buying decision. The responses of the respondents were recorded on a grade scale of strongly disagree, uncertain, agree and strongly agree for each question. The filled up information was later analyzed to obtain the required interpretation and the findings.

Secondary Data:

In order to have a proper understanding, an in depth study was done from the various sources such as books, articles from leading journals, magazines, reports of agencies of national and international repute, various websites and the articles from various search engines like Google, yahoo search and answers.com.

Data Collection Tool

- 1. Strongly disagree
- 2. Disagree
- 3. Neither Agree nor disagree
- 4. Agree
- 5. Strongly Agree

Likert scaling is a bipolar scaling method, measuring either positive or negative response to a statement. The questionnaire consists of two parts. The first part consists of 10 questions concerning the demographic information of the respondent such as the name, age, educational qualifications, income, family size, power outage frequency etc. The second part consisting of 18 questions exploring the respondent's perception about the common factors influencing the consumers buying behavior.

DESCRIPTIVE STATISTICS

Statistics

				Family	Qualific	Occup	Income	Living	Is Power	Aware	SP	Future
		Age	Gender	Size	ation	ation	Grp	in	Cut	ness	Usage	Use
N	Valid	78	78	78	78	78	78	78	78	76	78	78
	Missing	0	0	0	0	0	0	0	0	2	0	0
Me	ean	1.67	1.13	4.49	2.56	6.10	2.79	7.13	2.28	2.79	1.59	.90
Me	edian	2.00	1.00	4.00	3.00	7.00	3.00	4.00	3.00	4.00	2.00	1.00

Frequency Table

	Age									
		Frequency	Percent	Valid Percent	Cumulative Percent					
Valid	1	32	41.0	41.0	41.0					
	2	40	51.3	51.3	92.3					
	3	6	7.7	7.7	100.0					
	Total	78	100.0	100.0						



	Gender									
	Frequency Percent Valid Percent Cumulative Perce									
Valid	1	68	87.2	87.2	87.2					
	2	10	12.8	12.8	100.0					
	Total	78	100.0	100.0						



	Family Size									
		Frequency	Percent	Valid Percent	Cumulative Percent					
Valid	2	10	12.8	12.8	12.8					
	3	10	12.8	12.8	25.6					
	4	22	28.2	28.2	53.8					
	5	14	17.9	17.9	71.8					
	6	12	15.4	15.4	87.2					
	7	10	12.8	12.8	100.0					
	Total	78	100.0	100.0						



Qualification										
		Frequency	Percent	Valid Percent	Cumulative Percent					
Valid	2	38	48.7	48.7	48.7					
	3	36	46.2	46.2	94.9					
	4	4	5.1	5.1	100.0					
	Total	78	100.0	100.0						


Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	10	12.8	12.8	12.8
	4	8	10.3	10.3	23.1
	7	58	74.4	74.4	97.4
	9	2	2.6	2.6	100.0
	Total	78	100.0	100.0	



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	8	10.3	10.3	10.3
	2	22	28.2	28.2	38.5
	3	30	38.5	38.5	76.9
	4	14	17.9	17.9	94.9
	5	4	5.1	5.1	100.0
	Total	78	100.0	100.0	



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	6	7.7	7.7	7.7
	3	24	30.8	30.8	38.5
	4	16	20.5	20.5	59.0
	6	10	12.8	12.8	71.8
	7	2	2.6	2.6	74.4
	9	2	2.6	2.6	76.9
	10	4	5.1	5.1	82.1
	14	6	7.7	7.7	89.7
	24	8	10.3	10.3	100.0
	Total	78	100.0	100.0	





Is Power (Cut
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	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1	28	35.9	35.9	35.9
3	50	64.1	64.1	100.0
Total	78	100.0	100.0	



Awareness

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	28	35.9	36.8	36.8
	2	4	5.1	5.3	42.1
	4	44	56.4	57.9	100.0
	Total	76	97.4	100.0	
Missing	System	2	2.6		
Total		78	100.0		



		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	8	10.3	10.3	10.3
	1	16	20.5	20.5	30.8
	2	54	69.2	69.2	100.0
	Total	78	100.0	100.0	



Future I	J se
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		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	24	30.8	30.8	30.8
	1	46	59.0	59.0	89.7
	3	8	10.3	10.3	100.0
	Total	78	100.0	100.0	



KMO and Bartlett's Test

- It is used to measure the sampling adequacy.
- It shows validity & suitability of responses collected to problem.
- Value of .664 indicates good analytical tool for factor analysis.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.664
	Approx. Chi-Square	135.758
Bartlett's test of Sphericity	df	21
	Sig.	.000

Conclusion:

- > The sampling adequacy is mediocre as the value in the table is 0.664.
- Therefore Factor Analysis is an appropriate analytical tool to describe the sample data.
- Bartlett's test of Sphericity indicates that the R-matrix is not an identical matrix and hence variables are not homogenous.

Cronbach's Alpha

- It is not a statistical testing tool.
- It is a coefficient reliability (or consistency).
- The value of alpha is 0.872 which indicates the internal consistency of the data.

Cronbach's Alpha	N of Items
.872	7

Conclusion:

> The value of alpha shows that the data is good for further analysis.

Total Variance:

Component	Initial Eigen Values			Rotation Sum of Squared		
					Loading	ŞS
	Total	% of Cumulative		Total	% of	Cumulative
		Variance	%		Variance	%
1	2.798	39.976	39.976	1.822	26.024	26.024
2	1.257	17.959	57.935	1.676	23.940	49.964
3	1.028	14.687	72.622	1.586	22.658	72.622
4	.695	9.926	82.548			
5	.524	7.489	90.037			
6	.378	5.405	95.442			
7	.319	4.558	100.000			

Extraction Method: Principal Component Analysis

Rotated Component Matrix:

	Component				
	1	2	3		
Economical	.751	089	.335		
Durability	.834	.221	210		
Environment Friendly	.279	.293	.721		
Low Maintenance	.141	.900	.089		
High Return	.081	.819	.268		
Latest Technology	.676	.189	.287		
Renewable	.029	.126	.865		

Rotation Method: Varimax with Kaiser Normalization.

Conclusion:

It shows that product attributes like Economical, Durability and Latest Technology are the most sought after factors. Low Maintenance and High returns are second most sought after factors. Environmentally and Renewability are the least factors on which consumer focus.

Component	1	2	3
1	.606	.575	.549
2	.789	522	325
3	.100	.630	770

Component Transformation Matrix

Rotation Method: Varimax with Kaiser Normalization.

Conclusion:

It is evident from the table that there are three components in the study which are available to explain 72.6% of variance of the data.

Media

		Frequency	Percent	Valid	Cumulative
				Percent	Percent
	word of mouth	20	40.0	40.0	40.0
	tv advertisement	13	26.0	26.0	66.0
Valid	Newspaper	7	14.0	14.0	80.0
	social network	10	20.0	20.0	100.0
	Total	50	100.0	100.0	

<u>Conclusion</u>: From the above table it is evident that, the most influential media is word of mouth.

FINDINGS

- 1. The consumers mainly focus on product attributes like economical, durable and high return on investments.
- 2. The consumers are giving more importance to the performance of the product than the price.
- 3. The consumers who prefer the performance of the product indirectly prefer the durability of the product.
- 4. The consumers also prefer that the product should be more environment friendly and shall use latest and established technology.
- 5. The Consumers have given more importance to word of mouth than other promotional media as it is the most influential media these days.

RECOMMENDATIONS

- 1. The company must establish R&D department.
- 2. Most of the people are not aware of solar products, so the company must bring awareness in people through various promotional activities.
- 3. The company must educate the people in rural areas about the solar products.
- 4. The company must bring awareness in people about government subsidies on solar products.
- 5. The company must educate the farmers about working of their solar water pumps.
- 6. The company must improve their distribution channel.
- 7. The company must improve after sales service.
- 8. The company must recruit efficient engineers.

LIMITATIONS

- 1. A small sample size of 100 consumers is taken, so exact inference cannot be drawn about the population from this sample size.
- 2. Time period was short and resource constraints.
- This study was based on the prevailing consumer's perception toward solar products but it may change according to time, technology and development, etc.



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Annexure

Study of Consumer Perception toward Solar Power Products

Greetings!!

This survey is being conducted for research purposes. Your response is precious to us which will help us to carry out this study further. Your responses will remain confidential and anonymous. We further assure you that your responses will not be analyzed individually. We truly appreciate your efforts to spare some time to fill this survey and share your opinions. Thanking you in anticipation.

Q2 Please select the age group you belongs to.

- **O** 18 30 Yrs (1)
- O 31 40 Yrs (2)
- **O** 41 50 Yrs (3)
- **O** 51 60 Yrs (4)
- **O** Above 60 Yrs (5)

Q3 Please select your gender.

- **O** Male (1)
- **O** Female (2)

Q4 Please mention your family size (total members) in the space provided below.

Q5 Please specify your educational background.

- O Up to Class 12th (1)
- **O** Graduate (2)
- O Post-Graduate (3)
- **O** Others (4) _____

Q6 Please select your occupation.

- **O** Government Employee (2)
- **O** Private Employee (7)
- O Business (4)
- O Homemaker (5)
- O Others (9) _____

Q7 Please select your monthly income group.

- **O** Up to 25,000 (1)
- **O** 25,001 50,000 (2)
- **O** 50,001 75,000 (3)
- **O** 75,001 1,00,000 (4)
- **O** More than 1,00,000 (5)

Q8 Please select the area you live in.

- O East Delhi (1)
- O West Delhi (2)
- O North Delhi (3)
- O South Delhi (4)
- O Central Delhi (5)
- O Ghaziabad (6)
- O Noida (7)
- O Gurgaon (8)
- O Faridabad (9)
- O Other Metro City (10)
- O Other Non-Metro City (11)

Q9 Do you face problem of daily power cuts in your area?

- **O** Yes (1)
- **O** No (2)
- O Can't Say (3)

Answer If Do you face problem of daily power cuts in your area? Yes Is Not Selected

Q10 How frequently do you face power cuts in your area?

- **O** 1 2 times in a Week (1)
- **O** 3 6 times in a Week (2)
- **O** 1 3 times in a Month (3)
- O 4 8 times in a Month (4)
- O Rarely (5)

Answer If Do you face problem of power cuts on daily basis in your area? Yes Is Selected

Q11 Please mention average number of hours per day for which power supply cut happens?

Answer If How frequently do you face power cuts in the area you live in? Never Is Not Selected Or Does the area in which you live faces power cuts on a daily basis? Yes Is Selected

Q12 Which of the following power backup system(s) do you use during power cuts?

- Emergency Lights (1)
- □ Inverter Battery System (2)
- □ Society Power Backup Connection (3)
- Generator (4)
- □ Other, please mention (5) _____

Q14 Are you aware of Solar Power Solutions?

- **O** Completely Aware (1)
- O Somewhat Aware (2)
- Totally Unaware (3)

Answer If Are you aware of Solar Power Solutions? Completely Unaware Is Not Selected

Q15 How did you come to know about these solutions?

- \Box Television (1)
- □ Newspaper (2)
- □ Friends/Relatives (3)
- □ Social Media (4)
- □ Road Shows (5)
- **Exhibitions** (6)
- □ Roadside Hoardings/Billboards (7)
- □ Others, please specify (8) _____

Answer If Are you aware of Solar Power Solutions? Completely Unaware Is Not Selected

Q16 Do you use any Solar Power Solution(s) at home?

O Yes (1)

O No (2)

Answer If Do you use Solar Power Solution(s)? Yes Is Selected

Q17 Please select the type of Solar Power Solution(s) you use?

- □ Solar Lanterns (1)
- □ Solar Home Lighting Systems (2)
- □ Solar Water Heater (3)
- □ Solar Power Add-On to charge Inverter Battery (4)
- □ Solar Power Plant (5)
- □ Others, please specify (6) _____

Answer If Do you use Solar Power Solution(s)? No Is Selected

- Q18 Would you like to use Solar Power Solution(s) in near future?
- **O** Yes (1)
- **O** No (2)
- O Can't Say (3)

Answer If Would you like to use Solar Power Solution(s) in near future? No Is Not Selected

Q19 Which type of Solar Power Solution(s) you would like to use?

- □ Solar Lanterns (1)
- □ Solar Home Lighting Systems (2)
- □ Solar Water Heater (3)
- □ Solar Power Add-On to charge Inverter Battery (7)
- □ Solar Power Plant (5)
- □ Others, please specify (6) _____

Answer If Are you aware of Solar Power Solutions? Completely Unaware Is Not Selected

Q20 Which of the following brands are you aware of?

- □ Central Electronics Limited (1)
- □ First Solar (2)
- □ Hi-Tech Solar (3)
- Luminous Solar (4)
- □ Maharishi Solar (5)
- □ MIC Electronics (6)
- □ Moser Baer Solar (7)
- **Rashmi Solar (8)**
- SELCO Limited (9)
- □ Solar World (10)
- □ Solid Solar (11)
- □ Sukam Solar Power (12)
- □ Sun Energy Systems (13)
- $\Box TATA Power Solar (14)$
- □ Universal SolarTech (15)
- □ Vikram Solar (16)
- □ Vimal Electronics (17)
- □ Others (18) _____

Answer If Do you use Solar Power Solution(s)? Yes Is Selected

Q21 Please mention Solar Power Solution Brand(s) you are currently using.

- 1 _____
- 2 _____
- 3 _____

Answer If Are you aware of Solar Power Solutions? Completely Unaware Is Not Selected

Q22 Which factor(s) attracts you towards adopting Solar Power Solutions?

- □ Based on Latest Technology (1)
- \Box Durable (2)
- Economical (3)
- **Environment Friendly (4)**
- □ High Returns on Investment (5)
- **Requires Low Maintenance (6)**
- $\Box \quad \text{Renewable (7)}$
- □ Others (8) _____

Answer Invalid Logic Click Here to Edit Logic

Q23 Please rate the following factors in terms of their importance, for selecting any Solar Power Solution.

	1 (Lowest) (1)	2 (2)	3 (3)	4 (4)	5 (Highest) (5)
After Sales Support (1)	Ο	Ο	0	О	0
Brand Name (2)	Ο	Ο	О	О	0
Durability (3)	Ο	Ο	О	О	0
Ease of Availability (4)	Ο	Ο	О	О	0
Looks & Style (5)	Ο	Ο	О	О	0
Maintenance Required (6)	Ο	Ο	О	О	0
Offered Warranty (7)	Ο	Ο	О	О	0
Performance (8)	Ο	Ο	О	О	0
Popularity (9)	0	Ο	О	О	•
Price (10)	Ο	Ο	О	О	0
Sales Offers (11)	0	0	О	0	0

Q24 How would you like to collect information about latest Solar Power Solutions on your own?

- □ Internet (1)
- □ TV Advertisements (2)
- □ Newspapers (3)
- □ Friends/Relatives (4)
- □ Company website (5)
- □ Magazines (6)
- □ Social Media (7)
- □ Local Sales Office (8)
- □ Online shopping websites (9)
- □ Others (Please specify) (10) _____

Answer If Are you aware of Solar Power Solutions? Completely Unaware Is Selected

Q25 Would you like to receive information about Solar Power Solutions?

O Yes (1)

O No (2)

Answer Invalid Logic Click Here to Edit Logic

Q26 Are you aware of a system that uses Solar Power to charge inverter batteries ?

- **O** Yes (1)
- **O** No (2)

Answer If Are you aware of a system that uses Solar Power to charge inverter batteries ? Yes Is Selected

Q27 Would you like to receive information about other Solar Power Solutions like Solar Power Plant, Solar Water Heater e.t.c.?

O Yes (1)**O** No (2)

Answer If Are you aware of a system that uses solar power to charge inverter batteries ? No Is Selected

Q28 Would you like to receive information about such solutions?

O Yes (1)

O No (2)

Answer If Would you like to receive details about such solutions? Yes Is Selected Or Would you like to receive details about Solar Power Solutions? Yes Is Selected Or Would you like to receive details about other Solar Power Solutions; Solar Power Plant, Solar Water Heater e.t.c.? Yes Is Selected

Q29 How would you prefer to receive information about Solar Power solutions from our experts?

- □ Personal Interaction (1)
- **E**-Mail Communication (3)
- **Telephonic Conversation** (2)
- □ Social Networking (4)

Answer If How would you prefer to receive information about Solar Power solutions? q://QID57/SelectedChoicesCount Is Greater Than or Equal to 1 Q30 Please mention your contact details to enable us reach out to you.

Name (optional) (1) Contact Number (2) Address (3) E-Mail Address (4) Social Networking Account Name (5)