

**A Research Proposal**  
**On**  
**A STUDY OF ADOPTION AND DIFFUSION OF NEW AND**  
**RENEWABLE ENERGY TECHNOLOGY PRODUCTS FOR**  
**DOMESTIC USE**

Submitted to  
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## Contents

### **1. Introduction**

#### **1.1. Energy Scenario**

*1.1.1. Global energy scenario*

*1.1.2. Indian scenario*

*1.1.3. Scenario of Punjab*

#### **1.2. Scenario of New and Renewable Energy Technologies for domestic use.**

*1.2.1. Solar Photovoltaic's*

*1.2.2. Solar Thermal*

*1.2.3. Biogas*

*1.2.4. Smokeless chulahas*

*1.2.5. Pellet stoves*

### **2. Review of Literature**

*2.1 Marketing Environment*

*2.2 Consumer Behavior-Adoption of innovation*

*2.3 Marketing Strategy-Diffusion of Innovation-models*

*2.4 Government Policy Initiatives*

### **3. Objectives of the study**

### **4. Methodology**

4.1. Overview

4.2. Need

4.3. Purpose

4.4. Design

4.5. Measurement

4.6. Scope of study

### **5. References**

## **Introduction**

The population of the world continues to grow, so does the average standard of living, increasing demand for food, water and energy and placing increasing pressure on the environment. The population of the world doubled from 3.2 billion in 1962 to 6.4 billion in 2005 and is forecasted to grow to 9.2 billion in 2050. Supplies of oil, gas, coal and uranium are forecast to peak as reserves are depleting. At the same time, fear of climate change is putting pressure on the energy sector to move away from carbon burning to nuclear, solar and other environmentally friendly options. (BP Statistical Survey, 2011)

### ***World Energy Scenario***

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

In 2004, 18% of world electricity came from hydro and 16% from nuclear. In 2006, according to the IEA, the main sources of electricity worldwide were coal (39.8%), gas (19.6%), hydro (16.1%), nuclear (15.7%), oil (6.7%) and other renewable (1.8%). The contribution of coal is growing at a rapid rate compared to all the others. There is renewed interest in nuclear but hydro is stagnant. As of March 2007, Africa was using 5% of its hydro potential compared to Asia (40%) and Europe (80%).

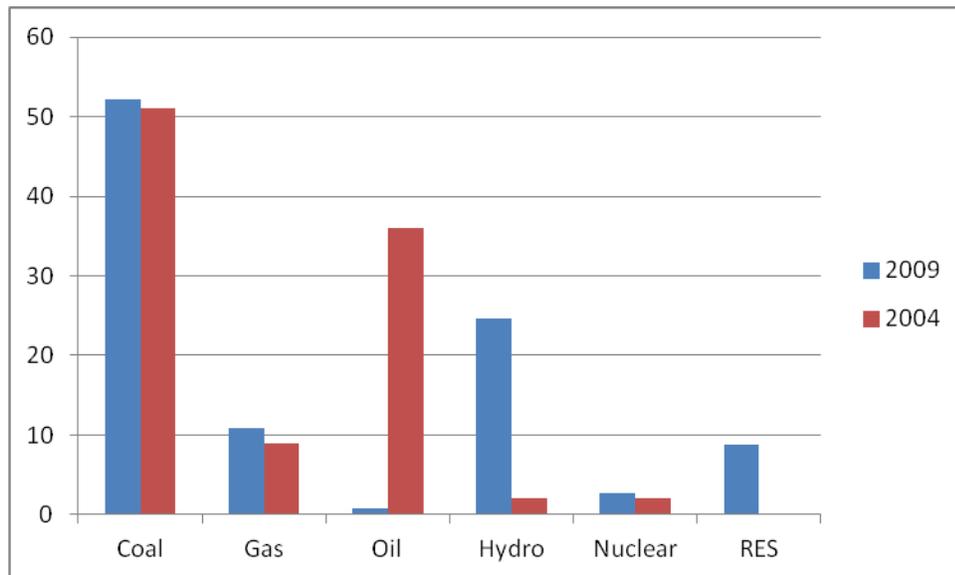
### ***Indian scenario***

According to the world standards, Indian consumption of energy is low and approximately 330 Million Tonnes Oil Equivalent (MTOE) of energy is consumed annually. Thus, the per capita consumption of energy is 305 Kilogram Oil Equivalent. In comparison to Indian statistics, the energy consumption of USA is 7850, that of Japan is 4050, for China it is 1200 and for OECD countries it is approximately 4670 and the world average is 1690 as per the reading in 2004.

If we focus on Indian electricity consumption the level is around 600 kilowatt (Kwh) per head per year. In the area of electricity consumption the data for USA is 13,000 kwh, for Japan is 7800, for China the figure is 1380, for OECD countries the consumption is 8050 and the world average stands at 2430. Therefore, it is evident that Indian consumption of energy and electricity

is low and that applies for the world average even. To increase this level of consumption India is planning to improve the basic existential standard of living of Indians to fulfill the target of 9-10%. It is noteworthy to mention here that India has already touched the level of 8% presently. The idea right now is that electricity availability is smoothened for Indians in order to achieve the target in a time of 10-15 years.

In 2004, coal as an energy source for India is contributing around 51% of its primary energy resource, oil constitutes 36%, natural gas 9%, nuclear 2% and hydro 2%. To launch the idea of achieving its target, India is focusing both on supply as well as use of energy. There is no doubt that India has to radically expand the capacities on all the fronts as well as tighten up the strings for customization of its usage. The corresponding figures for 2009 are coal 52.2 %, gas 10.8, Oil 0.8, Hydro 24.6, nuclear 2.7 % and renewable energy sources 8.8 % .



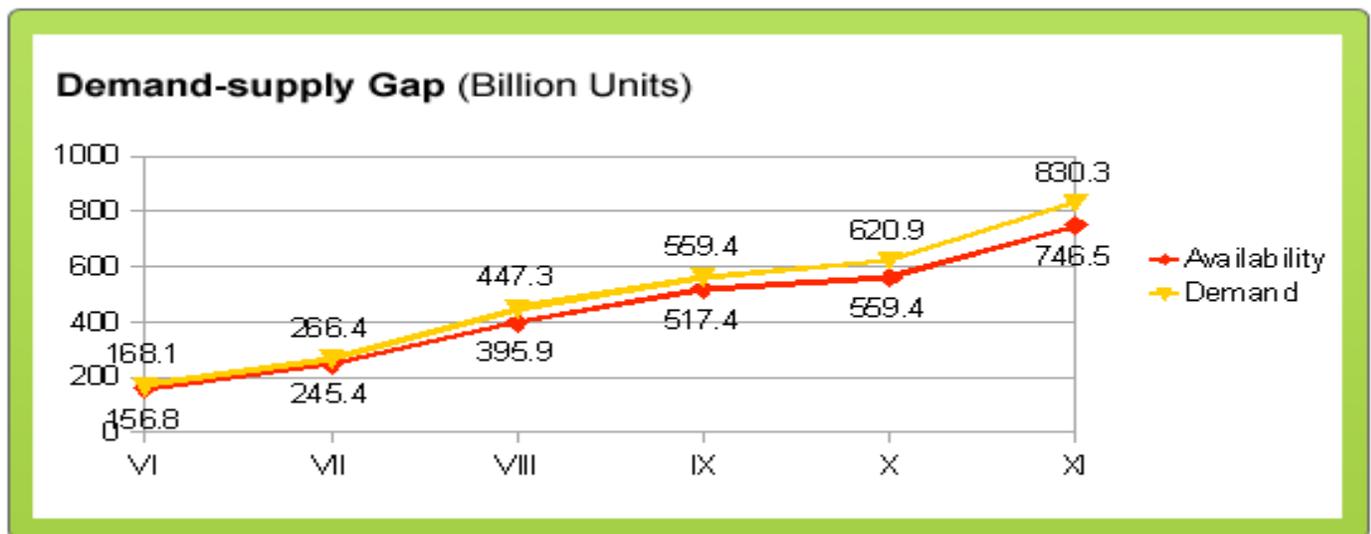
*Share of various sources of energy in India*

There is a wide gap between the demand and supply of energy for India and this has led to the focus on one more as compared to the other. For many years to come, India would focus on exploiting all the fronts to increase capacity for energy aspect. The coal production has to be increased largely even the other sources such as oil and natural gas have to catalyzed. The nation will need to continue its dependence on import of oil and focus strictly on hydro electric potential which is of the grade of 1,50,000 MW. So far only 20% of hydro electric potential has been used. The coal reserve worth 200 billion tones also needs to be enhanced. The nuclear

power plants have been established and after a few initial hassles, the power supply from these nuclear power plant has been abundant. Wind Turbine Technology has been successfully implanted in India and presently 1, 25,000 MW of energy is generated through various non-conventional sources of energy generation. This is 5% of the total energy generated in the country.

There is immense scope on the demand side of energy management as well. On account of random sampling, the fact that 20% of energy is wasted emerges which becomes the prime area of our concern. Energy Conservation Act has been established by the Indian government in the year 2001. For the implementation of the above mentioned law, the Bureau of Energy Efficiency is formulated. The bureau has postulated adequate measures for the energy efficiency plan. The programme includes demarcating the various sectors where energy consumption needs attention and standardizing and labeling of energy consumption gadgets.

#### Demand Supply gap of power in India from VI to XI five year plans



“India has always been a power-deficient country. The demand for power is huge in India. As seen in the above graph, the supply of power in India has not been able to meet its demand. Under the Government’s “Power for all by 2012” plan, it has targeted per capita consumption of 1000 kWh by the end of the 11th Five Year Plan (2007-2012) as compared to levels of 734 kWh in 2008-09. In order to provide per capita availability of over 1000 kWh of electricity by year 2012, it is estimated that capacity addition of more than 1, 00, 000 MW would be required. This

shows that huge capacity additions are required at good efficiency rates, indicating that the opportunities available in this sector are huge” (as stated by [stockshastra.moneyworks4me.com](http://stockshastra.moneyworks4me.com))

### ***Scenario of Punjab***

Punjab as a state does not have coalmines, natural gas, tidal power, and oil as a source of energy. The possibility of wind energy is also very low since the wind speed is low and the distance from the sea is vast. There is good scope for nuclear and solar energy which is yet to be harnessed. The state has three perennial river which are a source of hydroelectric power and also the state has three thermal power plants .The state is among the highest peak hour consumer of electricity, around 7700MW .Since the shortage of water is there the state has to rely on thermal power but cost of thermal energy is high and it is polluting also. The state government is now considering the option of non-conventional energy sources and has also commissioned two power plants from this source. The finances of states with respect to electricity are in a bad shape since it continues to supply subsidized power to the 37 % of its consumers, the farmers.

### **New and renewable technologies as an option**

India’s major achievements with regard to renewable energy development can be summarized as follows:

- Over 4200 MW grid power wind, small hydro, biomass and solar energy
- 3600 remote villages/hamlets, including those in Sundervan, Bastar, Ladakh and the North East electrified through solar energy.
- Deployment of 7.5 lakh solar photovoltaic systems for lighting, communications and related uses.

*Chaturvedi.P, (2005)*

As per the EAI report (2010) the potential for electricity generation with the help of Photo voltaic is about 5000 trillion KWH and of which only 150 MW has been exploited as on date. Similarly for solar thermals the potential is around 140 million sq mtrs whereas the exploited potential is 3.5 million sq mtrs.The case of biogas is also similar where potential for 12 million plants exists and only 3.5 million had been installed till 2005.The major contribution in the

exploitation of these perennial resources and relatively expensive resources has been limited to large public projects, however there exists a huge potential even at the individual consumer or the household level. A host of products have been available since last two to three decades for domestic application but these technologies have yet not witnessed widespread adoption.

## **2. Renewable energy technologies for domestic use.**

**Photovoltaic's (PV)** is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect. Photovoltaic power generation employs solar panels composed of a number of solar cells containing a photovoltaic material. Materials presently used for photovoltaic include silicon, polycrystalline, amorphous silicon, cadmium telluride, and copper indium gallium selenide/sulfide.

**Solar thermal energy (STE)** is a technology for harnessing solar energy for thermal energy (heat). Solar thermal collectors are classified by the United States Energy Information Administration as low-, medium-, or high-temperature collectors. Low-temperature collectors are flat plates generally used to heat swimming pools. Medium-temperature collectors are also usually flat plates but are used for heating water or air for residential and commercial use. High-temperature collectors concentrate 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 matter in the absence of oxygen. Organic waste such as dead plant and animal material, animal dung, and kitchen waste can be converted into a gaseous fuel called biogas.

### **Some of the New Energy Technology Products for domestic Use.**

**Smokeless Chulah** is the improved versions of the conventional chulaha, and has higher utilization of heat and a design which makes the fumes exit from a chimney thus making the cooking relatively smoke free.

**Pellet stove** is a stove that burns compressed wood or biomass pellets to create a source of heat for residential and sometimes industrial spaces. By slowly feeding fuel from a storage container (hopper) into a burn-pot area, they create a constant flame that requires little to no physical adjustments.

**Some leading companies dealing in Renewable Energy products**

<b>Company</b>	<b>Products</b>	<b>Location</b>	<b>Website</b>
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<b>TATA BP Solar</b>	High quality, low-cost crystalline silicon cells (both mono- and multi-crystalline) and solar modules.	<b>Corporate Office</b>  <b>Tata BP Solar India Limited</b> Plot No. 78, Electronics City Hosur Road <b>Bangalore</b> 560 100 Tel : 080 4070 2000, 4070 2200 Fax : 080 28520 116	www.tatabpsolar.com
 <b>Maharishi Solar Technology</b>	Photovoltaic cells, photovoltaic modules, photovoltaic systems, solar electric power systems, solar outdoor lighting systems, telecommunications power systems, solar powered railway signalling systems, solar powered navigational aids, Solar Power Plants .	<ul style="list-style-type: none"> <li>A-14, Mohan Co-operative Industrial Area, Mathura Road, New Delhi, NCR Delhi India 110 044</li> </ul>	<a href="http://www.maharishisolar.com">http://www.maharishisolar.com</a>
 <b>Central Electronics Limited</b>	Photovoltaic cells, photovoltaic modules, photovoltaic systems.	781, Desh Bandhu Gupta Road, Karol Bagh, New Delhi-110005, India	<ul style="list-style-type: none"> <li><a href="http://www.celindia.co.in">http://www.celindia.co.in</a></li> </ul>
<b>Bharat Heavy Electricals Ltd, Electronics division.</b>	<ul style="list-style-type: none"> <li>Photovoltaic modules of ratings, Photovoltaic systems -Grid interactive, Stand alone and Hybrid. Photovoltaic cells (monocrystalline) ranging from 2.1 to 2.4 wp.</li> </ul>	<ul style="list-style-type: none"> <li>SC&amp;PV dept, P.B. No. 2606, Mysore Road, Bangalore, Karnataka, India 560 026</li> </ul>	www.bheledn.com
<b>Moser Baer Photo Voltaic Ltd</b>	Photovoltaic cells,	43 B, Okhla	www.moserbaerpv.in/

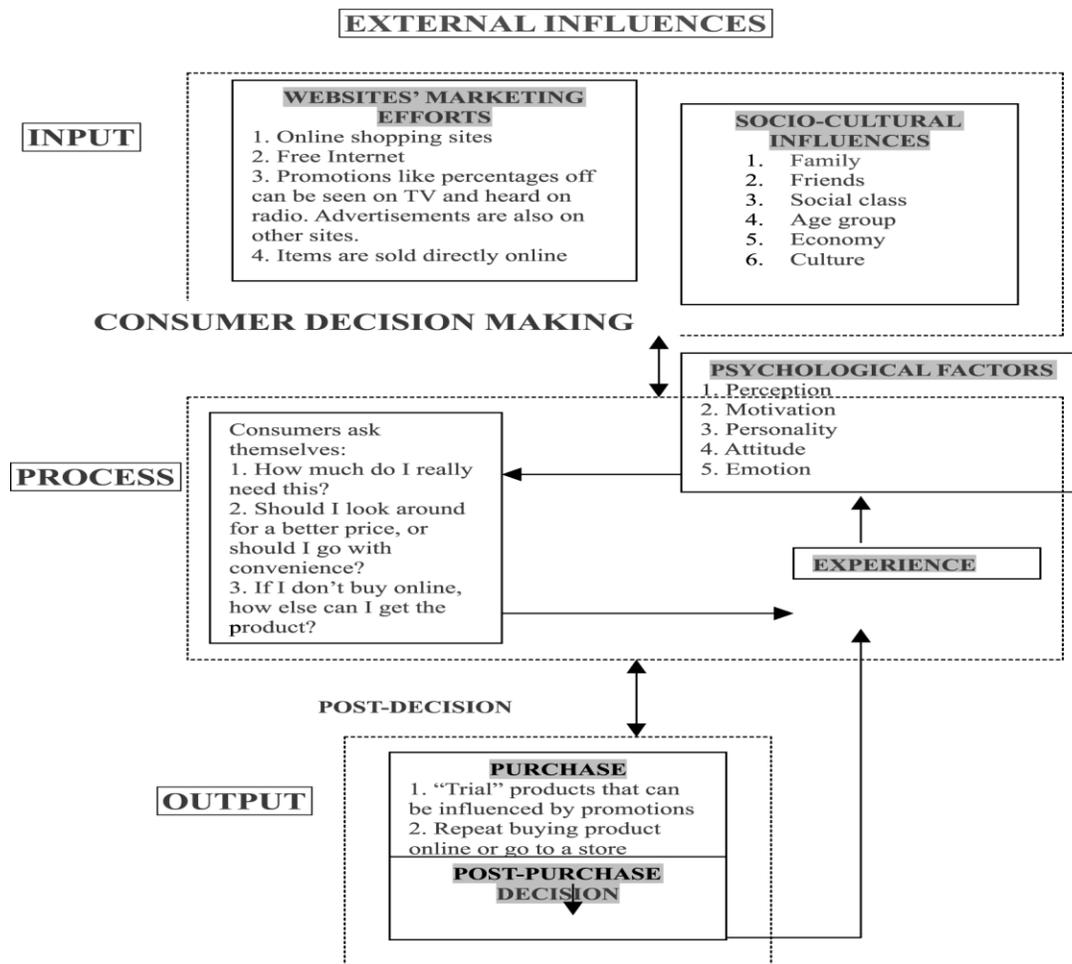
	<p>photovoltaic modules, photovoltaic systems, solar electric power systems, sun concentrating photovoltaic systems, solar electric power systems.</p>	<p>Industrail Estate Phase 3, New Delhi, Delhi India 110020</p>	
<p><b>Solarium Solar Power Systems</b></p>	<p>Manufactures and Exporters Of Solar Products. Solar Water Heaters, Solar Invertors, Solar Street Lights, Solar Garden Lights And Many More</p>	<p>Shop No.1, Avtar Nagar, Opp. Sartaj Palace, Ferozepure Road Octroi, Ludhiana. M: 98780022131</p>	<p><a href="http://www.solarium.co.in">www.solarium.co.in</a></p>
<p><b>Radha Energy Cell</b></p>	<p>Solar inverters, water heaters, charge controllers, Solar cookers, Solar Street lights</p>	<p>1st Floor, Deol Market, Rajesh Nagar, Haibowal Kalan, Ludhiana 141001 (Punjab) India</p>	<p><a href="http://www.solarexporterindia.com">www.solarexporterindia.com</a></p>

## **Review of Literature**

### ***2.1 Theoretical framework: Broad Marketing Environment***

Vernon (1996) in his theory of product life cycle has identified products in the introduction stage as those products which have low demand, high cost of production. In other words, these are those products which have just entered the market. Renewable Energy technological products like the solar water heater have been in the market for over a hundred years as reported by the California Energy Centre. 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 RET (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 them training in Solar Energy Technology, marketing, sales, business administration. This has now given access to 3 lac people in just three years. A similar experience has been for 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 potential. The adoption 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 to play in their acceptance. Some of the scientists are of the 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. Since 1990's not just the government of the developed countries like the US but also many private firms have invested heavily in research and development of photovoltaic as observed by Asgley ( 1992).



## 2.2 Adoption of Renewable energy products: Consumer Behavior

Schiffman and Kanuk (2007) have suggested the model mentioned above for **Consumer Decision Making**, which takes into consideration the interactions of various external influences and personal factors which come to play while the consumer makes a purchase decision. Under the light of this model we can observe that a steady trend in the interests, concerns, and perception for environment friendly products has been observed by Murphy et. al (2008) and

Hansa (2007)). Consumers of different products have varied expectations from the marketers, those interested in health and wellness expect more efficiency, and value for money, and therefore want that the marketers should adopt measures like, combining environmental and economical sustainability, since the purchase intent is more in personal lifestyle products, the green claim should be reinforced and supported adequately at the retail level. Fairer & Neame (2006) have observed that in the United Kingdom the policy for stimulating the market has not resulted in widespread adoption of RET 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 characteristics. 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 behavior for solar products is a typical phenomenon, since the attributes that drive to purchase solar products are slightly different as that of usual products and education and income have 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 consumer still remains price sensitive as 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 pertinent 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 size of the product, cost, awareness and availability, especially 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:

- **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 (PEOU)** -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 fail 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 considering to adopt new technology majority

**RQ1 : 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**

### **2.3 Diffusion of Renewable energy products: Review of Marketing Strategy**

*The renewable energy products in India are still at an early adoption stage and therefore it would appropriate to still treat them as innovative products and study their diffusion in the light of the theories explain the innovation diffusion process.*

#### **2.3.1 The Models and theoretical framework for the study of diffusion.**

Sui, M. & Li, Y. (2011) have identified that the diffusion of technological innovation is the most important in innovation diffusion research. They have observed that various authors have approached the theory from various perspectives however the application of the theory will continue to expand with social progress, technological advancement and continuous rise in emerging industries. The study observes that the study of diffusion of innovation can be categorized into Macro research –which encompasses study of variables like advertising, brand image, price and competition with Bass model and its modified models being the prominent in this category. The second category is of Micro-research which has simulation models of complex systems that with the help of software are effective in prediction of success of new innovations.

Boyle, Kumar and Kumar(2006) developing a model for Integrated Product Development( IPD),have concluded that the complexity of IPD practices and support for IPD directly

influences IPD diffusion, while an innovative organizational climate and the complexity of organizations NPD activities indirectly influence IPD diffusion through IPD support .

Rogers (1995) observed that the complexity of an innovation is negatively related with its rate of diffusion. However, inspite of the benefits that RET products promise, different countries have shown behavioral variance. While some nations namely U.S, U.K. which are ahead in RET usage per person are raising the question, 'Why is RET product penetration rate slow? Should organizations should focus on the idea of improving the product concurrent product development approach for RET products is an area of research. The focus on developing a model of the organizational contextual factors influencing the diffusion of RET products in India is a must with special focus on solar energy products at the household level.

Renewable energy is nourished within a no geologic i.e. biologic time frame and is therefore renewed when the source is provided in a sustainable manner. (Heiman and Solomon 2004). The consumers choosing to purchase green energy (biogas fuels) would also spur the development of the renewable sources i.e. solar electricity (Caster 1998; Moore 2006). This assumption forms the base of connecting the missing links. While the study endeavors to access both the promise and the performance of solar renewable energy during the current era of electric utility reconstruction and market reform, it also seeks to unravel the hurdles in the expectations.

However, the above major achievements are in themselves minor ones and need a lot of pivotal attention. The launch activities have to be meticulously planned and executed at the initial level of inception. The performance effect of launch activities targeted at customer adoption barriers has been subject to a number of previous investigations. (Hultink et al 1997). The empirical analysis so addresses the question, 'How far the success rate of solar energy products shall be? posed by stakeholders (household group). Thus, by putting a little more focus on the elements of the marketing mix when conceptualizing the launch tactics, a lot of help can be rendered in bringing the customers as the main actors in the process of new product diffusion in the centre of attention.

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 higher usability, functional efficiency, and certain level of customization have higher acceptance. 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 with lower 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 ,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.

**RQ2: 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.**

## **2.4 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 encourage 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 stimulus provided by the Government to encourage and support the manufacturers who are manufacturing green products by providing subsidies, loan facilities, Tax incentives will also help the small and medium scale manufacturers as green marketing is costly, Awards and recognition should be given to those who successfully practice green marketing which becomes a motivating factor for others to implement it observes Welling. (2010). Social advertising should be carried out on a large scale through various medias to promote environment friendly practices and to promote the consumption of green products. Promotion of Eco-mark or Eco-labeling has to be done to create awareness not only amongst manufacturers but also consumers.

The development of markets for renewable energy in India for large-scale use of, renewable energy products and technologies have been hampered by their high up-front capital costs; the renewable energy industry's inadequate access to credit; subsidies for fossil fuels; and low purchasing capacity among potential consumers. While conventional funding and financial instruments such as capital subsidies, donor grants, and tax rebates and similar fiscal incentives have been able to achieve a certain level of penetration, the large-scale use and commercialization of renewable energy products and technologies requires innovative approaches to the selection and delivery of financial instruments and mechanisms. Yuvaraj, Dinesh and Babu (2003) have explored four instruments that are likely to be primary sources of finance for the development and commercialization of renewable energy technologies and products in the mid to long term: government finance; international funding; private-sector finance (including financing through energy service companies); and micro-credit and community-based finance. The challenge of financing is addressed under a life-cycle approach, which looks at financing mechanisms for the phases of: research and development; demonstration; early commercialization; and demand-driven commercialization on two renewable energy sectors that are particularly relevant for developing countries: Solar and wind power.Meisen,P.(2006) has also discussed the idea about renewable energy potential in India. Indian Government using Financing Sources and Incentives to promote renewable energy

technologies in the country, the government have put in place some subsidies & fiscal incentives. The Indian Renewable Energy Development Agency has been set up under Ministry for Non-Conventional Energy Sources 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.

**RQ 3: Why has the policy initiative of the government not been able provided the intended impetuous to the widespread adoption and diffusion of New and Renewable Energy Products?**

**H6: The government has adequately formulated, but not implemented and communicated the policy to stimulate the diffusion adoption of New and Renewable Energy products.**

### **3. Objectives of the study**

1. To identify and asses the factors affecting the customers' 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 and Renewable energy products for domestic use.

## 4. Methodology

### 1. Overview

The study is primarily aimed at identifying the gaps in the understanding of the various stakeholders in the adoption and diffusion of the renewable energy products. Punjab was chosen as the geographical area because the socio-economic condition and the power situation of the state are conducive for the widespread adoption and diffusion.

### 2. Need

The study is relevant because most of the studies done in the area have been done in developed countries like UK, US and Australia. Some researchers in India studied individual products like solar cooker and solar thermal products but those studies are very old and also the perspective is not marketing. Ministry of New and Renewable Energy has formulated a strategic plan for the sector for the period of 2011-17 but very much like earlier government initiatives even this has not resulted in creating excitement in the minds of the consumers and the marketers of RET products. It is therefore imperative to study the adoption and diffusion process and suggest meaningful insights to the stakeholders.

### 3. Purpose

The study is being conducted so that the gap in the understanding of in the internal and external factors influencing consumers adoption decision can be identified and correspondingly the changes can be suggested in the marketing approach of New and renewable energy products. ***This study is being conducted with the aim of finding a solution to the problem of ever increasing price and supply shortage of energy, by way of suggesting better marketing efforts for the new and renewable energy products.***

### 4. Design

The research being empirical in nature ,at the exploratory stage interviews would be conducted by way of snowball sampling, of users, prospective buyers ,industry experts, policy makers/Implementers(Malhotra & Dash,pg 80) for the identification of the variable to be studied. The design would be further strengthened by way review

of articles from leading journals, magazines, books and reports of agencies of national and international repute.

The descriptive study would involve administering of structured questionnaire /Interviews from the current users and prospective users by way of quota sampling for adoption part of the study. In-depth interviews would be conducted for the diffusion part of the study by way of judgmental sampling.

A sample of approximately 800-1000 respondents (Users, non-users) using quota sampling would be done for adoption study, similar studies, Krishnaswamy (2006) have taken a sample size of approximately 400 for conducting research at a minor level. For studying the diffusion part 40-50 respondents (Manufacturers, retailers covering Punjab market) on the basis judgmental sampling would be covered as per their location in the state and outside the state.

A secondary study of the policy initiatives would be conducted before the adoption and diffusion study.

1. Strategic Plan of the Ministry of New and Renewable Energy for 2010-2017
2. Policy initiatives of the Punjab Energy Development Agency
3. Marketing communications of the various suppliers of renewable energy products.
4. Reports of various governmental and non governmental agencies related to the field of study.

## **5. Measurement**

*Appropriate research tools would be developed or borrowed for measurement of variables.*

## **6. Scope of study**

The study would be conducted in the urban and rural areas of Punjab. Being a state with conducive 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. The state also boasts of high literacy levels of 81% for males and 71% for females, as per the census of 2011, which can aid in conducting the study in a scientific manner.

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