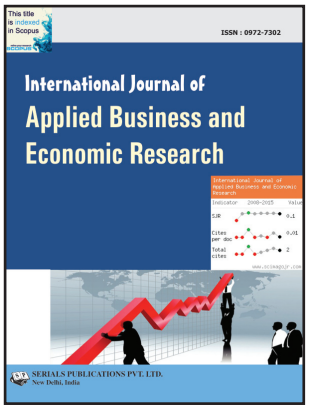

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Solar Residential Rooftop Systems (SRRSs) in India: PEST and Environment Analysis

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ABSTRACT

India's future growth depends upon many factors like political stability, government vision, efficient production, health services, education, availability of drinking water, speedy and comfortable public transportation, quality power supply, social equality etc. Among all the factors the electricity is one of the most important factors which works as a catalyst for improving the overall quality of life of billion of Indians. Therefore, government of India (GOI) keeps on revising the targets for producing electricity including the adoption of new technologies. After analyzing the advantages and disadvantages of producing electricity through technologies like thermal, hydro, wind, nuclear, solar etc; GOI substantially revised its targets of generating electricity through solar energy from 20 GW to 100 GW by 2022. This target of 100 GW includes 40 GW of distributed energy generation through solar rooftop systems. In order to achieve 40 GW from solar rooftop systems, there is requirement of installing solar rooftop systems on residential buildings also. This paper is an attempt to examine the impact of five most significant external factors – Political (P), Economy (E), Social (S), Technological (T) - PEST and Environmental (E) related to Solar Residential Rooftop Systems (SRRSs) in India.

Keywords: Solar energy, Environment, Solar Residential Rooftop Systems (SRRSs), PEST analysis, Renewable energy.

1. INTRODUCTION

Businesses are highly influenced by forces outside their industry. These factors are normally considered as political, economical, social, technological and environmental. How do the companies mange these external factors reflect the future of their products and industry as a whole. These factors are also known

as macro uncontrollable factors (MUFs) (Sarin, 2009). Macro uncontrollable factors could be classified in the following two categories:

(i) Macro Uncontrollable Favorable Factors (MUFFs)

(ii) Macro Uncontrollable Unfavorable Factors (MUUFs)

PEST analysis is the tool to understand macro uncontrollable factors for business and their further analysis in the above mentioned categories MUFFs and MUUFs; provides an opportunity to decision makers for utilizing the MUFFs for the growth of organization, and the strategic management of MUUFs for reducing the side effects to minimal (Sarin, 2009). PEST is formulation and synthesizing of political, economic, social and technological factors for strategic analysis of products, industry and companies. In this paper PEST and Environment Analysis have been applied on Solar Residential Rooftop Systems (SRRSs) to understand the impact of political, economical, social, technological and environmental factors for the promotion of SRRSs in India.

Solar power is a clean form of electricity production and can be easily installed on residential rooftops. Solar panels can be installed on residential rooftops; they convert solar energy into electrical energy. DC power generated by solar panels is converted to AC power with the help of inverters. Solar power can be used for household consumption. The excess amount of power generated by solar panels can be fed into grid. At night time or times of the day when demand is more than supply from SRRSs; power supplied through grid can be used.

As there are lot of benefits associated with solar residential rooftop systems (SRRSs) such as it is clean form of energy, low gestation period, no fuel cost, negligible operating cost etc. it is in the interest for all stakeholders (governments - central and states, marketers, consumers, environmental groups, society etc.) to promote SRRSs in India.

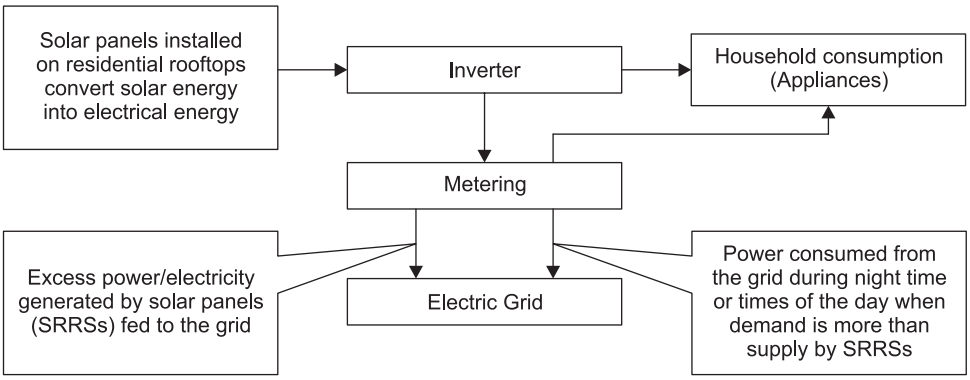


Figure 6.1: Generation and Utilization of Power from SRRSs

This paper is also an attempt of identifying Macro Uncontrollable Favorable Factors (MUFFs) and Macro Uncontrollable Unfavorable Factors (MUUFs) for SRRSs in India. The identified MUFFs and MUUFs would enable the stakeholders of SRRSs to formulate their strategies, by utilizing the benefits of MUFFs to the maximum and reducing the side effects of MUUFs to the lowest for promoting SRRSs in India.

Therefore, analyzes of these factors would be a great help for stakeholders to achieve the objective of promoting SRRSs in India both extensively and intensively.

2. LITERATURE REVIEW

Most of the textbooks on strategic management discuss PEST analysis. The PEST analysis is a useful tool for understanding market growth or decline and as such the position, potential and direction for business. The study of macro environmental factors becomes crucial for understanding the present and future existence of product (Kotler, 1997). It is the manifestation of four major macro factors which have the potential of breaking and making of any business on this earth. External factors are influencing business more frequently than past, therefore, their analysis reveals the impact on business (Koumparoulis, 2013). Kotler and Schlesinger 1991 claimed that by analyzing the macro environment factors, the fundamental business concepts about product, organization and industry could be utilized for decision making in more meaningful manner. Maini (2016) mentioned that the objective of providing 24x7 electricity to every citizen of India without adding to carbon print, the alternative is to keep targets of solar power production high. In fact, at present 80% of oil and 20% of coal is being imported to meet India's energy needs and that too at the cost of larger carbon print with flying ash which has polluted many Indian cities as most of the power production in India is through coke and oil. Therefore, government is encouraging solar system and increasing investments in research and development for new technologies in this area.

India should also invest in manufacturing quality photovoltaic (PV) modules the way China is producing more than USA, Japan and other countries. India needs to give priority to the generation of solar power as it has many advantages than other technologies available for producing electricity. As per Harinarayana and Kashyap, in spite of lesser area than India and few sunny days, Germany is near to achieve solar super power status with the strength of its research and development capabilities. India is advantageous country owing to its ideal geographical location resulting in higher solar radiation (Harinarayana and Kashyap 2014). After 50 years of independence, the demand for energy in India was dependent on coal and oil thermal plants. In the last twenty years, due to globalization and change in life style of people, India created huge demand of power which was not easy to fulfill with the existing poor infrastructure in India (Anandan and Ramaswamy 2014). Most of the developed countries like USA, Japan, Germany and Australia have support schemes for roof top solar PV installations. India is also falling in the same category as it has also introduced the schemes for roof top solar PV like direct capital subsidy, renewable portfolio standard (RPS), special financing schemes, tax benefits, self consumption incentives etc. The Government of India has kept the target to achieve 100 GW of solar capacity in the country by 2020, whereas 40 GW is the target through decentralized roof top solar projects (Sundaray, Mann, Bhattacharjee, Garud and Tripathi 2014).

3. POWER SCENARIO IN INDIA

In 21st century, whole world is seeking growth and prosperity. It is possible through continuous economic and social development. Economic development is based on the industrial production along with the growth of service sector. Social development depends on the key areas like education, health, security etc. In order to achieve both economic growth and social development, there is a common factor which acts as a major contributor for the overall development (economic & social) in all the countries and that is electric power.

In the beginning of 21st century, many technological inventions took place to produce electricity. At present India is having many options to produce electricity like thermal, nuclear, solar, wind, hydro and others. India currently (till 31.05.2016) has total installed capacity of 303083.21 MW (303 GW) as per

Central Electricity Authority (CEA). Thermal power accounts for 70% (212 GW) of this installed capacity, hydro power 14% (43 GW), wind power 9% (27 GW) and solar power accounts for only 2% (7 GW) of this installed capacity. India's installed capacity is dominated by thermal power which occupies a major chunk in the installed power capacity.

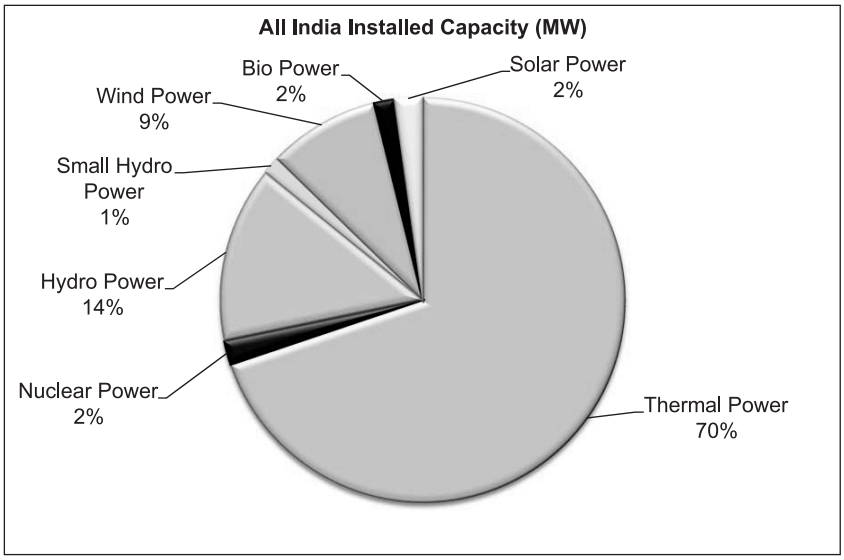


Figure 6.2: All India Installed Capacity (MW)
Source: **(Central Electricity Authority, Ministry of Power, Government of India, May 2016)**

Solar power can be easily captured by installing solar panels which generate electricity. Solar power is being seen as a transformative solution to meet energy as well as economic challenges, both globally and nationally. Solar rooftop installed capacity further constitutes a small portion of the total installed power capacity in the country. Total installed rooftop capacity in India as on 31st March, 2016 is 740 MW (Statista, 2016).

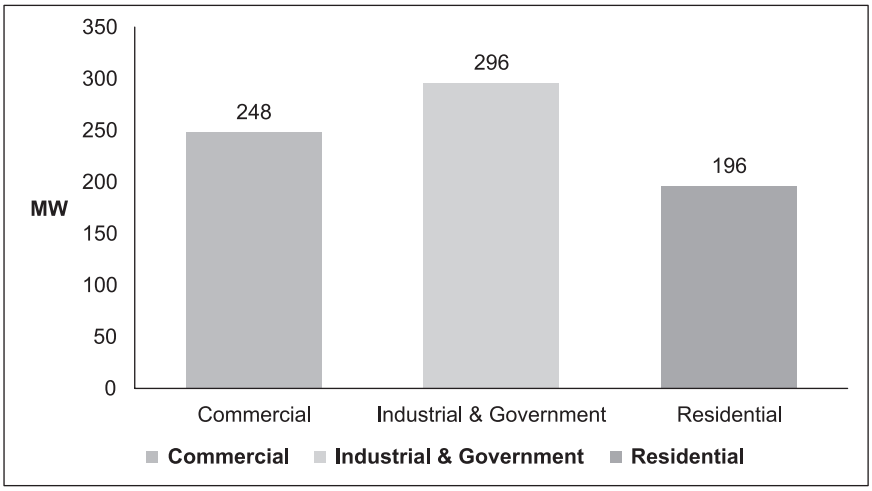


Figure 6.3: Installed Solar Rooftop Capacity (MW) as on 31st March, 2016
Source: **(Statista, 2016)**

Solar Residential Rooftop Systems (SRRSs) constitute only 26% of this share with installations of about 196 MW out of total installed capacity of 740 MW.

Per capita consumption of electricity in India is 765 Kwh/year which is way below the world average of 3104 Kwh/year and the highest in world is 54799 Kwh/year (World Bank Statistics). Economic growth and development of India would require huge power capacity additions and there would be substantial increase in per capita power consumption. Moreover India's population touched around 131 crores in the year 2015 (The World Bank, 2016). India is the world's second populated country and will surpass China by 2022 (BBC News, 2015). With growing population there is greater demand for power. Therefore there is a greater need for reliable, affordable, quality and clean power.

It has been estimated that realistic market potential for rooftop solar PV in urban settlements of India is about 124 GWp (TERI, 2014). This accounts for almost 41% of the India's current installed capacity of 303 GW. Thus, rooftop solar PV can play an important role in growth and development of the country with additional benefits such as energy security, effective utilization of land along with the conservation of environment.

In view of the above it is important to analyze the macroeconomic factors such as political, economical, social, technological and environmental influencing SRRSs under the concept of PEST and Environment analysis and to identify MUFFs and MUUFs for promoting SRRSs in India effectively.

4. PEST ANALYSIS

4.1. Political Factors

Political factors play important role in macro environment of a product, company and industry. Political factors affect almost every sector in the country. Power sector is also highly regulated sector and is affected by government rules and regulations/policies. Government bodies make and enforce the laws that make up the legal environment of organizations/industry. Political factors mostly include government policies, rules and regulations, leadership, tax regimes, trade restrictions or reforms, bureaucracy issues etc.

The base legislations/acts which govern India's power sector are an integral part of Electricity Act, 2003. Electricity Act 2003 has laid great importance for development and promotion of renewable sources of energy in the country. Various commissions and regulatory bodies have been setup at different levels for promoting the adoption of power from renewable sources including solar power. The governments (both central and state) through various legislations/acts have also set up a minimum quantum of power to be purchased through renewable sources of energy and have named it as Renewable Purchase Obligation (RPO) - Solar RPO and Non Solar RPO. The governments (central and state) have given much importance to the solar power in particular therefore these RPOs have come up separately for solar, i.e. Solar RPOs. Solar RPO means obligation to purchase power from solar power generators only. Obligation to purchase power generated from other renewable sources of energy have been clubbed together under one umbrella and being mentioned as Non Solar RPOs.

Government of India is so keen to develop and promote the renewable power sector in India that it has setup a separate Ministry at the central level and named it as Ministry of New and Renewable Energy – MNRE (www.mnre.gov.in).

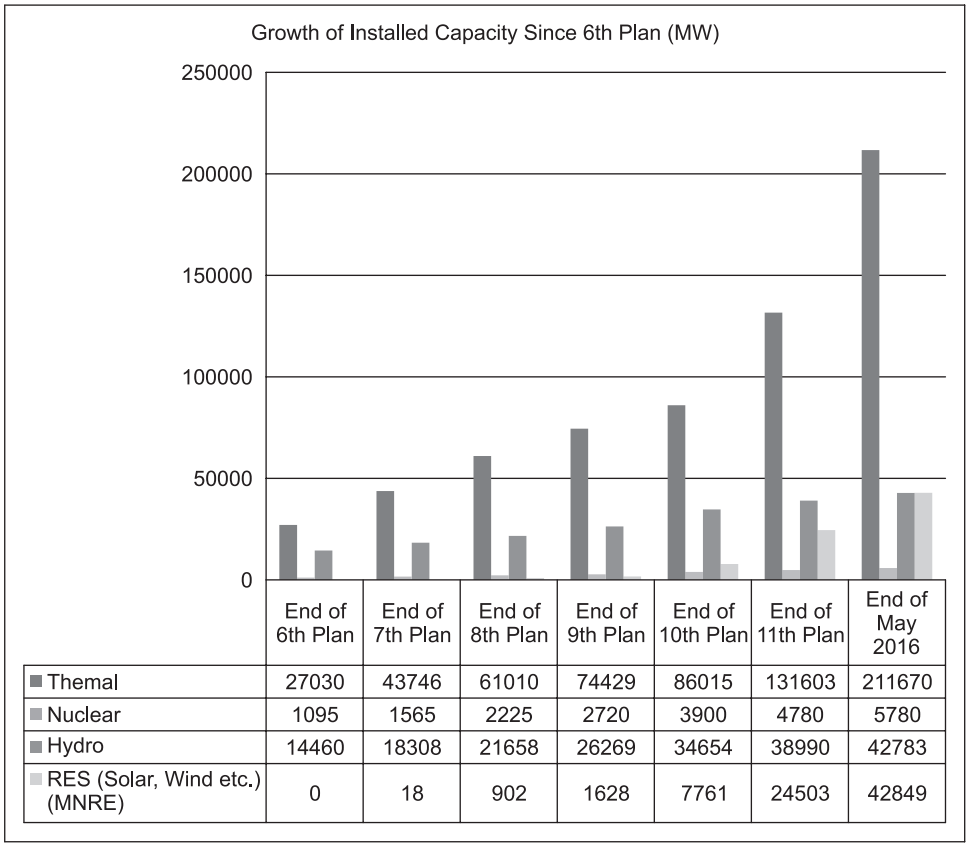
Specialized technical and management institutions have also been setup to provide technical assistance for setting up of renewable energy projects such as Solar Energy Corporation of India (SECI), National Institute of Wind Energy (NIWE), National institute of Solar Energy (NISE) etc.

The Electricity Act, 2003 mandates SERCs to provide suiTable 6.measures for ensuring proper connectivity to generators generating power from renewable sources of energy and also sale of electricity to third party. Various nodal agencies and departments have been setup by respective state governments for providing technical and economic support for setting up of power plants based on renewable sources of energy.

The MNRE's financial organization - Indian Renewable Energy Development Agency (IREDA) has been set up with the mission - "Be a pioneering, participant friendly and competitive institution for financing and promoting self-sustaining investment in energy generation from renewable Sources, Energy Efficiency and Environmental Technologies for sustainable development". IREDA is engaged in promoting, developing and extending financial assistance for setting up projects relating to new and renewable sources of energy and energy efficiency/conservation with the motto: "ENERGY FOR EVER" (www.ireda.gov.in).

Since independence India gave more importance to thermal power production as technology of thermal power was in much advanced stages in comparison to other sources of power, coal was available in abundance. Solar power generation technology was in nascent stage of development.

Table 6.1
Growth of Installed Capacity since 6th Plan (MW)



	End of 6th Plan	End of 7th Plan	End of 8th Plan	End of 9th Plan	End of 10th Plan	End of 11th Plan	End of May 2016
Themal	27030	43746	61010	74429	86015	131603	211670
Nuclear	1095	1565	2225	2720	3900	4780	5780
Hydro	14460	18308	21658	26269	34654	38990	42783
RES (Solar, Wind etc.) (MNRE)	0	18	902	1628	7761	24503	42849

Source: (Central Electricity Authority, Ministry of Power, Government of India, May 2016)

The Ministry of New & Renewable Energy (MNRE), GOI in July, 2015, revised target for solar power from 20 GW to 100 GW by 2022 (60 GW grid connected and 40 GW rooftop). This could be achieved by establishing large solar power plants on land and also by installing the solar systems on the rooftops.

Table 6.2
Rooftop Solar Target

Year	*Rooftop Solar Target (MW)*	*Cumulative Rooftop Solar Target (MW)*
2015-16	200	200
2016-17	4800	5000
2017-18	5000	10000
2018-19	6000	16000
2019-20	7000	23000
2020-21	8000	31000
2021-22	9000	40000

Source: (Ministry of New and Renewable Energy, Government of India, 2015)

Political analysis reveals that this was for the first time when solar rooftop was given a separate mention and such ambitious targets have been set up for solar rooftop systems in the power policy of the Government of India. Political environment is favorable for SRRSs in India as also the present government has increased the targets of solar power production from 20 GW to 100 GW which includes 40 GW from solar rooftop systems. Therefore political factors fall in the category of MUFFs i.e. macro uncontrollable favorable factors.

4.2. Economic Factors

Economic conditions and government policies are closely related. Economic factors are the important pillars of the macroeconomic environment. Economic factors can also affect the market of SRRSs as they are linked to the buying power of the market (customers). They include GDP, per capita income, inflation, financing options, subsidy, taxes & duties, international trade agreements etc.

The Cabinet Committee on Economic Affairs (CCEA) has approved the scaling up of budget from ₹600 crore to ₹5,000 crore for implementation of grid connected rooftops systems over a period of five years up to 2019-20 under National Solar Mission (NSM). This will support Installation of 4200 MW Solar Rooftop systems in the country in next five years (Press Information Bureau, Government of India, 2015).

The capital subsidy of 30% is being provided for general category States/UTs and 70% for special category States i.e., North-Eastern States including Sikkim, Uttarakhand, Himachal Pradesh, Jammu & Kashmir and Lakshadweep, Andaman & Nicobar Islands. Today it is possible to generate solar power from the solar rooftop systems at about ₹6.50/kWh. This is cheaper than the diesel gen-sets based electricity generation. It is also cheaper than the cost at which most DISCOMs would make power available to the industrial, commercial and high-end domestic consumers (Press Information Bureau, Government of India, 2015).

As solar residential rooftop systems have high capital investment broadly two models of financing are in practice

- CAPEX model
- RESCO model

In CAPEX model the customer pays the capital cost for installation of SRRSs. Mostly the following mechanism are adopted for billing of electricity generated through SRRSs

- Feed in Tariff
- Net Metering

In feed in tariff model the solar residential rooftop consumer feeds the electricity generated by the system into the grid at a predetermined tariff as per state solar policy. In Net metering the electricity generated by SRRSs is first consumed by consumer and remaining power if any is fed into the grid. This power is adjusted against the power consumed by the customer from the grid and billed accordingly.

Units Billed = Units imported from the grid – Units exported to the grid

In RESCO model the rooftop owner rents the rooftop to the developer/third party for installation of SRRSs. The capital cost involved for the purchase and installation of SRRSs is borne by the developer/third party. The electricity generated by the SRRSs is sold to the customer at a predetermined tariff (PPA) or fed into the grid as per state tariff policy.

Foreign financial institutions (KfW, World Bank and Asian Development Bank) are also supporting the promotion of solar rooftop systems in India by financing the projects.

Table 6.3
International Financing

Foreign Financial Institutions	*Loan Amount*	*Mode of Disbursement*
KfW	1 billion euro loan	Through banks with reduced interest upto 8%
World Bank	USD 500 million for low cost infrastructure finance	Through private developers to install systems on RESCO Mode, low cost EMI Mode. System to be owned by developer initially
Asian Development Bank	Proposed USD 5 million	Through banks, private developers, State Nodal Agencies

Source: (Ministry of New and Renewable Energy)

The State Bank of India (SBI) and the World Bank (WB) signed agreements for a facility of USD 625 million for supporting grid connected rooftop solar program. This facility will help SBI in financing grid connected rooftop solar photovoltaic projects at very competitive rates (State Bank of India, 2016).

The cost of setting up of SRRSs is one of the important factors that could affect their market. It has been found in various researches and also while interacting with consumers that capital cost plays crucial role in the installations of SRRSs. Potential prospects find it difficult to shell out initial capital cost for setting up of SRRSs. As per MNRE'S solar rooftop calculator, capital cost of setting up of 1 KWp system involves investment of ₹75,000 (Ministry of New and Renewable Energy, Government of India, 2015 – 2016). The higher initial capital investment involved in setting up of SRRSs makes them unfavorable for the consumers and thus it comes in the category of MUUFs.

4.3. Social Factors

Dynamic social forces can significantly influence the demand for products. Social factors play a very important role for the adoption and growth of product and same is also true in case of SRRSs. Social

environment encapsulates demand which vary with disposable income, living standard and size of family. Society is made up of people living in a community/region involved in number of activities with manifestation of effort of being economically independent resulting in improving quality of life on continuous basis. Economical activities by the members of the society are achieved by selling and purchasing services and goods which could be materialistic like refrigerators, LED lights, SRRSs and services like education, health, transportation etc. Livelihood by many individuals in the society is also achieved by offering/selling their personal talent, knowledge, expertise, skills, behavior, qualities etc. in the form of being an employee of a company, organization or government services. Therefore, every product or service is designed for the people and finally people are going to buy a product or service and use it. So it becomes very crucial to evaluate the social factors in order to study the macroeconomic factors related to a product or service such as SRRSs.

Factors that impact customer needs and size of markets are demographic, education level, attitudes and beliefs, lifestyle, ethics, influence and followings of religion, income level, awareness etc.

Quality and reliable power can help in upliftment of the society. In rural areas many people are not able to move out and earn as they need to complete all household chores within the day time itself due to unavailability/poor power in night time.

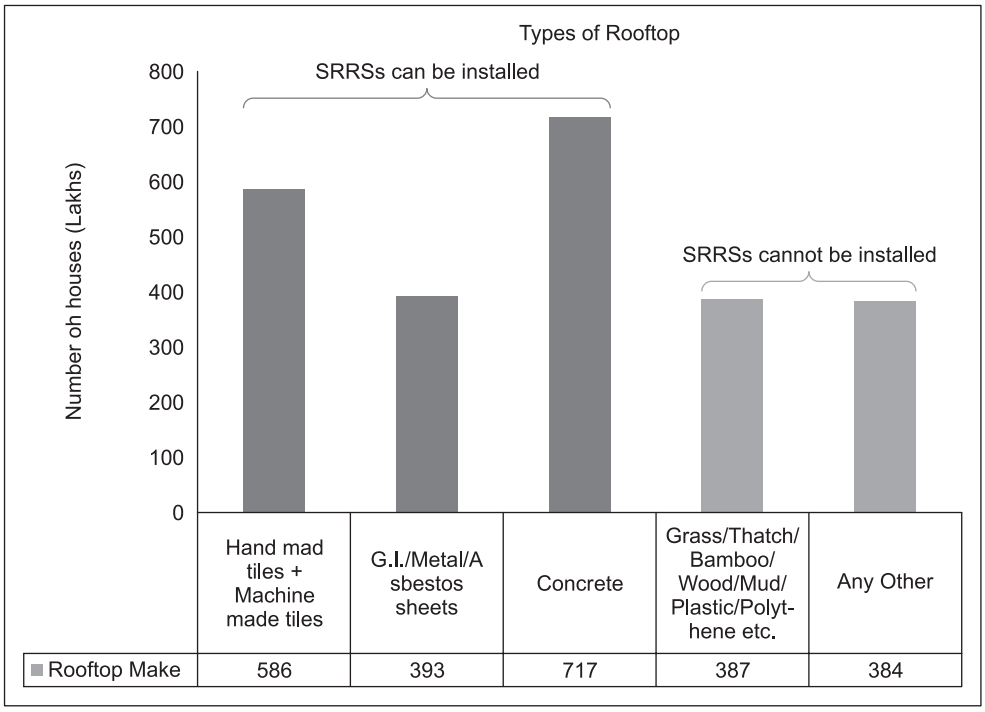


Figure 6.4: Types of Rooftop
Source: **(CensusInfo India 2011, 2011)**

There are about 1696 lakhs rooftops in India where solar rooftop systems can be installed. There is a huge potential for installation of SRRSs as per table. Once people become aware (both techno - commercial) about the SRRSs the market for these systems can grow manifolds. Since land is a scarce resource these days, not much of land is available for installation of power plants; vacant rooftop area can be used for installation of SRRSs. This will satisfy the power needs of country on one hand and also help to save environment.

As per official definition of electrified village, if 10% of the households of the village are electrified then it is considered as electrified village in addition to some basic infrastructure and electrification of public places such as schools, panchayat office, health centers, dispensaries, community centers etc (Issued by MOP, vide their letter no 42/1/2001-D(RE) dated 5th February 2004 and its corrigendum vide letter no 42/1/2001-D(RE) dated 17th February 2004).

There are about 6, 38,596 villages in India (Census of India 2001). Still as on September, 2016 there are about 7740 unelectrified villages in India (Ministry of Power, Government of India, 2016). About 67% of Indian population till 2015 lives in villages (The World Bank, 2016). So if we want to provide electricity to all the households in the village, there will be a huge requirement of power. In current scenario (environmental factors, economic factors, depletion of coal reserves, non availability of quality coal etc.) this demand of electricity can be met through SRRSs. This will also help in saving transmission line cost for far-flung villages and ensure availability of quality power to households.0185010155

Since land is a scarce and precious resource; there are a lot of land related issues involved in setting up of power plants. Land is not easily available; moreover, acquisition of land involves huge financial, legal check and social cost. In view of the above land constraints, setting up of SRRSs is easier and can easily satisfy power requirements of the country. Looking at no social unrest about SRRSs of any form, social factors fall in the category of macro uncontrollable favorable factors (MUFFs).

4.4. Technological Factors

Technology is the systematic application of scientific organized formal knowledge to practical aspects on continuous basis that includes techniques, inventions, generation of ideas, new materials etc. Technology is one of the important factors resulting in adoption and purchase of a product. Technology enhancement can help in bringing down the price of the product and at the same time provides improved quality product. Technological developments can significantly change the demand for an organization's product. Technological factors affecting the macroeconomic environment for a product includes rate of change of technology, research & development, quality, pricing, patents and licenses.

The world is changing at a faster than ever with the advent of new technology in every sphere of life. Same is true in the case of power generation. There are various technologies available for power generation such as

- Thermal power (Coal, Gas, Diesel)
- Wind power
- Hydro power
- Nuclear power
- Solar power

Thermal power accounts for major chunk i.e. 70% of the installed power capacity in India (Central Electricity Authority, Ministry of Power, Government of India, May 2016). As a result of regional, promotional and detailed exploration by GSI, CMPDI, SCCL, MECL, state govts. etc., a cumulative total of 301.56 billion tonnes of geological resources of coal have so far been estimated in the country as on 1.4.2014 (Ministry of Coal, Government of India, 2014). There has not been substantial addition in the total coal reserves in India. Since India has limited quantity of quality coal reserves for generation of power; coal

imports are on a rise. Moreover, thermal power is not regarded as a clean source of energy. Thermal power plants cause a lot of pollution and release greenhouse gases resulting in degradation of the environment and rise in global temperature.

Electricity from wind is generated by the use of wind turbines. These turbines are large in size and cause a lot of noise. It can also cause damage to birds, wildlife. There is huge land requirement for setting up of wind power plants. Moreover, wind speed is difficult to predict and there are few arid regions in the country for economical generation of wind power.

Hydro power plants use potential energy of water to generate electricity. There are few disadvantages associated with this form of energy production such as large land requirement for construction of dams, threat for aquatic life and ecosystem, displacement of people living in nearby villages resulting in social and political resistance, huge capital investment involved in construction of dams etc.

Nuclear power plants have high efficiency and lower emissions in comparison to thermal power plants. These plants require large land area and huge capital investment. These plants use radioactive material for generation of power. India doesn't have a large amount of nuclear fuel and there are a lot of issues at both domestic and international front associated with the import of radioactive material. Moreover, disposal of nuclear radioactive waste is a very critical issue as it is extremely hazardous and can cause radiations if not stored properly.

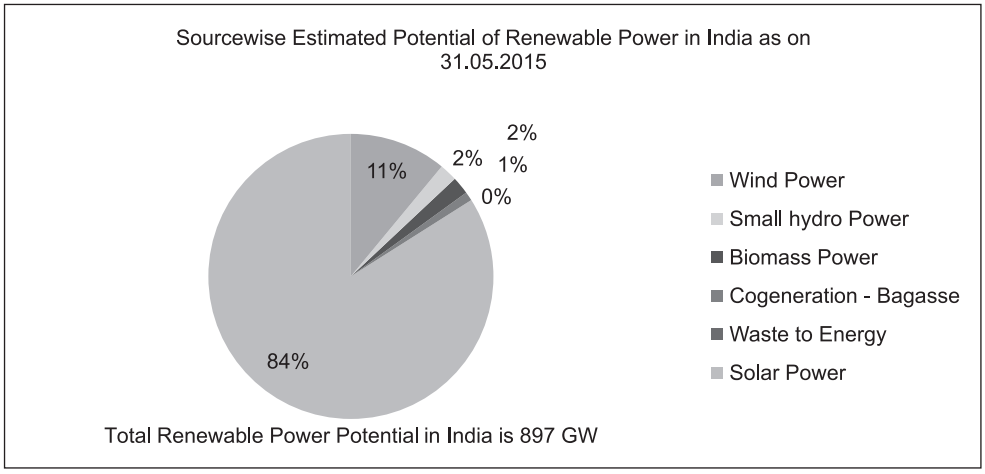


Figure 6.5: Sourcewise Estimated Potential of Renewable Power in India as on 31st May, 2016
***Source:* (CSO - Ministry of Statistics and Programme Implementation, Government of India, 2016)**

It has been estimated that among sources of renewable power in India, solar power has the greatest potential which is 753 GW or 84% of the total renewable power potential.

Solar Residential Rooftop Systems (SRRSs) are emerging as an attractive technology for solving power woes in the country. SRRSs technology has very less/nil operational cost associated with them. Major maintenance activity involves periodical cleaning of modules i.e. within every 15 days. No fuel cost is associated with the technology of SRRSs. It is one of the best technological options available in the market for distributed generation close to the point of consumption leading to reduction in transmission and distribution losses. SRRSs can make every household energy efficient i.e. households can consume what they generate. It is source of electricity which has inherited unique feature which could electrify the remotest areas of India where power distribution systems and grid connectivity are not available.

5. ENVIRONMENTAL FACTORS

India is endowed with vast solar energy potential. India lies in tropical region and is blessed with large amount of solar radiation with most parts receiving 4-7 kWh per sq. m per day. About 5,000 trillion kWh of energy per year is incident over India (Ministry of New and Renewable Energy, Government of India, 2016).

There is a pressure across various countries to cut down their emissions and move towards better non-polluting fuels. With climate change talks scheduled to take place in 2016, it is important to address this issue across different sectors; power sector is considered as one of the major contributors of CO2 emissions in the world. SRRSs on the other hand offer a lot of benefits such as

- Clean form of energy
- No fuel cost
- Availability of sun for most part of the year
- Low gestation period
- Point of generation and point of consumption are nearby leading to lower or negligible transmission and commercial losses
- Energy security
- Less wear and tear
- Low operation and maintenance cost
- Proper utilization of rooftop area as land is a scarce resource
- Storage options available at a affordable price
- Reduction of power bill by supplying surplus electricity to electric grid

As SRRSs are clean source of energy generation and don't have any hazardous impact on environment various world bodies are providing financial support for the growth of the sector. The target of 40 GW of distributed energy generation through solar rooftop systems will result in abatement of about 60 million tones of CO2 per year and will help to fulfill the commitment of India towards its contribution in mitigating the effect of climate change (Press Information Bureau, Government of India, 2015). Accordingly, a huge potential exists for setting up of SRRSs. If electricity from clean sources of energy is made available to people living in rural areas it can also help in drastic reduction in the use of polluting fuels such as kerosene, wood etc. Similarly it could result in abatement of diesel generator (DG) sets which consumes large amount of diesel and also cause air and noise pollution in urban areas. There is no scientific study available till date mentioning any threat to environment from SRRSs. As per environment analysis all the environmental factors are in favor of SRRSs and thus put them in the category of MUFFs.

6. CONCLUSION

Production of electricity through thermal, nuclear and hydropower have political, environmental, social and technological issues like pollution, depletion of coal reserves in case of thermal power generation; risk of emission of hazardous radiations from radioactive material in case of nuclear power. In fact for nuclear energy India is dependent on the whims and fancies of other countries for the technology of nuclear power plants and nuclear fuel – uranium. Hydropower energy needs building of dams which are considered as

threat to aquatic life, rehabilitation and resettlement of the displaced people. Displacement of people is a sensitive issue and results in political and social resentment.

PEST along with Environment analysis reveal that solar residential rooftop systems (SRRSs) are a case of MUFFs in the present scenario in India as these do not carry any political, governmental, social and environment activists' resistance. Economical factors for rooftop systems need some correction as getting SRRSs installed on household roofs require investment. Initial investment for installing SRRSs as per the analysis of economical factors under PEST falls in the category of MUUFs and it requires immediate attention and quick quality decision making of governments and corporate players involved in promoting SRRSs in India. In fact, governments (both centre and states) are trying to bring them to the reach of urban and rural population by providing subsidies, soft loans along with technological assistance etc. Governments have also provided SRRSs the option of supplying excess power to the grid enabling them to earn revenue out of it.

There is consensus among stakeholders – government, society, environmentalists, organizations (dealing in solar rooftops) and customers that SRRSs are green, clean and noiseless source of energy and thus makes them the most environment friendly systems. It is source of electricity, which could electrify the remotest areas of India where even power distribution systems and grid connectivity are not available. Solar energy can be harnessed till sun exists in the universe so there is no reason for this source getting diminished like fossil fuels.

However, the large-scale deployment of SRRSs will involve a combination of interventions involving policy and regulatory mechanisms, technological solutions and institutional structures. At present, the kind of technology for SRRSs is in its nascent stage which will take some time to reach to maturity level resulting in low cost production of electricity with lesser investment and maintenance.

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