



## SOLAR ENERGY- A WAY FOR EMPOWERING THE NATION

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### An ode to Surya

**“He is the embodiment of all the Gods. He is self luminous and sustains all with his rays. He nourishes and energizes the inhabitants of all the worlds as well as the host of Gods and demons by his rays.”**

### Abstract

Solar energy plays a significant role in the present era of energy crisis. There is an urgent need of empowering the nation by adding solar energy in its renewable energy mix. The study uses secondary data to show the growth of solar energy among various states in India. The study also describes about the major different technologies of solar energy and conducted a SWOT analysis of solar energy market.

**Key Words:-Solar Energy, Solar PV (Photovoltaic), Solar Thermal.**

### INTRODUCTION

Due to climate change and global warming issues, the governments all over the world turned their attention towards green actions especially in energy sector. In this present era, awareness of people increased about the environmental issues and they are willing to take appropriate measures to prevent the consequences resulted from their own actions. More attention must be given to the energy sector because energy is the sine qua non of all types of development of a country at the time, energy scarcity is became a buzz word today. Therefore renewable option got more s per capita income and per capita consumption of energy and some authors pointed out that about 40% of total consumed in the country is in rural areas of which domestic and agriculture sectors are the major sectors of energy demand and consumption (Promila Kadian and Sushma Kaushik 2003). So there is an urgent need to draw the attention towards green energy. Among all renewable sources, solar is the most viable and only decentralized form of energy which is abundant in India. Solar energy has been used since prehistoric times but mostly used before 1970. Sun is the source of all sorts of energy and remains as principle deity since human thinking began. In Hindu scriptures we began with “Ekam , Adityam” which means only one is Aditya. That means Aditya or sun was only source of energy and sun is the core of solar system and the entire planets move around him.

Every year the sun delivers 15000 times more energy than is consumed by the entire human population (Hermann Scheer, 1999) the sun is the origin of all types of energy directly and indirectly. During the day we get 43,200 seconds of solar energy free of cost taking in to account twelve hours of day in India, we got maximum hours of sunlight compared with many other countries of the world. Surface of the earth getting 1395kw solar energy per second per square metre,taking in to account average 310 days per year we get approximately 1,33,92,000 seconds of solar energy and to take advantage of this become essential in this present era of environment deterioration .

### SOLAR FOR RURAL DEVELOPMENT

Out of 600000 villages in India, 80000 villages are not electrified. Of these 18000 villages may never electrified from grid .It is estimated that about 500 million people in India are without access to commercial form of energy ,barring kerosene being used for small lighting This reflects the situation of energy poverty. The prime challenge before the country is to provide the minimum energy services to allow the poor people to achieve a decent standard of living. Solar energy is diffused in many parts of the world with the ambition to improve the situation in rural areas. The installation of solar home systems provide a convenient and sustainable way to power households by supplying high quality, reliable, clean and environmentally friendly energy services. A study of the world bank for 11 countries reveals that rural electrification results great benefits such as improvements of health facilities, better health from cleaner air as household reduce use of polluting fuels for cooking, lighting and heating, improved knowledge through increase access to television and better nutrition from improved knowledge and storage facilities from refrigerator .solar electricity has emerged as a key alternative to rural electrification. Many studies reported that there is a significant improvement in the children's education, standard of living after installation



of solar lighting. Crime rate has also declined due to availability of solar street lights in village and it can promote small commercial activities.

Solar energy can be harnessed through two routes.

- a) Thermal route
- b) Photovoltaic route

	Grid	Offgrid
Thermal	Concentrated solar technologies such as parabolic Through ,parabolic dish	Solar water heater Solar cooker,dryers, Thermal air conditioning
PV	Grid interactive Solar pv system	Solar signals Street lighting Water pumping system

**Thermal route:** solar thermal technology relies on capturing heat via a collector or solar panel in a fluid medium which is circulated by a pump. The main applications of thermal solar energy technology are:-

**Major thermal route products:-**

- Solar water heating
- Solar cooker
- Solar desalination system
- Solar dryer
- Solar space heating system
- Solar refrigeration

**Photovoltaic Route**

Photovoltaic technology makes use of the abundant energy in the sun and it has little impact on our environment. Photovoltaic can be used in a wide range of applications from small consumer item to large commercial solar electric system. The photovoltaic technology allows the direct transformation of the energy associated with solar energy in to electrical energy. Individual cells are arranged in modules of about 50 W peak capacity which can be linked to form large arrays .power Generation may be supplied to a national grid or used for remote application such as pumping water. The main application of solar photovoltaic technology is:-

- Solar power plant
- Solar lantern
- Solar home lighting
- Solar Street light
- Solar photovoltaic pump
- Solar mobile charger
- Solar cap
- Solar bag

Among the micro generation technologies, photovoltaic (PV) have showed a significant growth and pruned as a potential solution to energy policy challenges. Government all over the world is encouraging solar PV generation of electricity. One of the major measures adopted by the government is JNNSM (Jawaharlal Nehru National Solar Mission) which is one of the initiatives of NAPCC (National Action Plan on Climate Change). The objective of JNNSM is to harvest solar energy on a large scale in India. The mission has three phases with ultimate goal of adding 20000 MW of grid capacity and 2000 MW of off-grid capacity by 2022.

**Table No: 1-Targets under JNNSM.**

Phase	Time period	Grid connectedPower	Off-grid solar applications	Solar collectors
Phase 1	2007-2012	11000 MW	200 MW	7 million sq mt
Phase 2	2012-2017	10000 MW	1000 MW	15 million sq mt
Phase 3	2017-2022	20000 MW	2000 MW	20 million sq mt

Source –MNRE



**Table No:2 -Growth of solar capacity**

State	MWp	%
Gujarat	860.4	41.0%
Rajasthan	656.15	31.2%
Maharashtra	207.25	9.9%
Madya Pradesh	162.315	7.7%
Andra Pradesh	68.9	3.3%
Uttar Pradesh	17.375	0.8%
Tamilnadu	28.18	1.3%
Jharkhand	16	0.8%
Karnataka	24	1.1%
Orissa	15.5	0.7%
Punjab	9.325	0.4%
Haryana	7.8	0.4%
West Bengal	7.05	0.3%
A&N Island	5.1	0.2%
Uttarakhand	5.05	0.2%
Chhattisgarh	7	0.3%
Delhi	2.6	0.1%
Lakshadweep	0.8	0.0%

Source –ENVIS

**Solar capacities of world are leading countries**

Countries	Installed capacity(GW)
Germany	36.3
China	18.3
Italy	17.9
Japan	13.5
USA	12
Spain	5.34
France	4.67
United kingdom	3.4

**Solar PV Roof top potential in India**

India has been dependent on fossil fuel such as coal, oil, and gas for its energy requirements. More than 65% of its capacity is fossil fuel dependent. India currently imports about 72% of its total oil consumption and this share of imported oil is expected to reach 90% by 2031-32. The total estimated coal reserves in India is 51.09 billion tonnes. However the recoverable reserves are only 40.62 billion tonnes. So it is high time to adopt other alternatives for energy generation which also met sustainable development, most important one of our MDG.

PV offers highest versatility among renewable energy products and the potential for PV is enormous. The union ministry of new and renewable energy, encouraging small solar power generation facilities on rooftops of residential, commercial, and institutional complexes. On a national level, it reduces requirement of land for addition of solar capacities, it reduces transmission and distribution losses as power is consumed at the point of generation and it is the long term power source. Solar rooftops can make the governments ambitious target of installing 1 GW of solar power capacity. India is endowed with vast solar energy potential. About 5000 trillion kw per year energy is incident over India, s land area with most parts receiving 4-7 kw per sq.m per day. According to the IEA fact sheet, "renewable in global energy supply", the solar energy sector has grown by 32% per annum since 1971. while India receives solar radiation of 5 to 7 kwh/m<sup>2</sup> for 300 to 330 days in a year, power generation potential using solar thermal generation around 35mw/sq.m. The cost of solar pv had dramatically come down from a few hundred dollar to a few do- llars per watt. And it became more economically feasible to high-end residential and commercial customers with high electricity usage and high tariff. According to a report released by IRENA 1 million jobs are likely to be created in the sector by 2022. Today renewable energy sector employs more than 7.7



million people worldwide ,an increase of 18% from 6.5 million in 2014. If we take in to account the average tariff for consumers in the next 20 years and look at the cost of solar power generation for the same period,it can very well be seen that power generated from solar plants installed today would be cheaper than the average tariff for consumers.

## **SOLAR ENERGY PRODUCTS MARKET:-A SWOT ANALYSIS**

### **Strengths**

- Environmental friendly
- Environmental and health cost saved
- Carbon reduction
- Never ending source
- Scope for decentralization
- Less hazardous
- Reduce dependence on fossil fuels
- Achieve energy security
- Very useful to remote areas.( village electrification scheme)

### **Weakness**

- Costly equipment
- Solar energy not available in cloudy days.
- Varies according to season
- Energy generation depends on solar irradiation
- Initial investment is high
- Financial viability is question when compared to conventional sources
- Lack of trained installers
- Inadequate codes and standards related to PV
- Raw materials shortage.

### **Opportunities**

- Environment driven awareness
- Policy initiatives of government
- Great business opportunity
- Vast potential
- Rising cost of conventional energy.
- By bringing down the prices, it can be boon even for low income group
- Easy to install standalone systems
- Greater employment in rural areas
- Cost of fuel transport eliminated.
- Reduce the environmental issues.
- Long term benefits
- Incentives and rebates

### **Threats**

- Lack of consumer awareness and understanding
- Lack of promotional measures
- Subsidy complexity.
- Increase in battery cost
- lack of credibility for technology in public eyes.
- Lack of familiarity with technology among small dealers

## **FUTURE OF SOLAR ENERGY**

According to a recently released report from the international energy agency (IEA) called” solar energy perspective states that solar technologies could emerge as the panacea for all future energy problems and could well provide one-third of the world’s energy by 2060, if necessary policies are put in place. Solar energy technologies can play an increasingly larger role



in the future, in terms of reducing CO<sub>2</sub> emissions and enhancing energy security. Solar electricity is expected to grow rapidly in all IEA scenarios especially in the climate friendly scenarios as a result of deployment of a combination of solar thermal electricity /concentrated solar power and photovoltaics .Solar energy is expected to meet 5% to 7% of the power requirement of the country by 2021-22 displacing 16900 MW of conventional power ,thus saving 61 million tonnes per annum (MTPA) of coal .Further solar power can save 95 million tonnes of CO<sub>2</sub> per annum by 2022, which would be approximately equivalent to about 2.6% of India's total emissions in that year.

## CONCLUSION

Solar power is proving to be an attractive opportunity in terms of both business and power generation. Significant improvements have already been accomplished by numerous international, governmental, and non-governmental organizations including the funding and development of projects involving renewable energy systems for various developed as well as developing nations.. Funding for these systems, however, is a challenging aspect when considering the widespread demand. Fortunately, as more and more organizations volunteer their financial, professional and technical services, solar energy is becoming more cost effective. While progress has been slow but steady over the last two decades, the current efforts of industry leaders and researchers have greatly reduced costs and improved efficiencies, thus increasing the demand for solar energy systems. As the price of solar continues to drop amidst the rising cost of fossil fuels, the next decade is sure to see solar power as a primary, integrated, and cost-effective power source that reduces environmental impacts and increases energy security.

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