



Widening horizon of solar energy – A case study of alternative use of energy in India

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Abstract

Although non-renewable resources are an indispensable source of energy their limited existence or exhaustive nature and adverse environmental impacts are pushing this world to look for alternative i.e. resort to renewable energy which is generated from naturally replenishing resources like solar energy. The paper aims to lay emphasis on solar energy and understand how it meets the energy requirements of the concerned. It includes the application of energy in a village named *Bancha* in Madhya Pradesh and how it led to being India's first solar kitchen village.

Keywords: *Bancha*, Solar energy, Solar kitchen, Traditional stoves

Introduction

The world is experiencing a transformation- the use of renewable sources to meet one's energy requirements rather than depending upon the environment harming non-renewable resources is amplifying. Although non-renewable resources are an indispensable source of energy their limited existence or exhaustive nature and adverse environmental impacts are pushing this world to look for alternative i.e. resort to renewable energy which is generated from naturally replenishing resources like wind, hydro, solar, tidal etc. These fast-growing reliable

energy resources emit no direct greenhouse gases and reduce health-related threats by decreasing pollution.

The work aims to lay emphasis on one such renewable energy source i.e. Solar energy and understand how it meets the energy requirements of the concerned. It includes the application of energy in a village named *Bancha* in Madhya Pradesh and how it led to being India's first solar kitchen village.

Solar energy

The generation of heat from sun rays is not a new phenomenon. It ages way back around 700 BC when the concentration of sun rays by magnifying glass produced fire. With certain discoveries and innovations, scientists were able to generate electricity by simply harnessing sunlight. Thus, solar power is the transformation of energy from the sun into either thermal or electrical energy by making use of advanced technologies like solar heating, photovoltaics etc. These technologies can be utilized for a variety of purposes ranging from electricity generation,

producing light, to heating water. The photovoltaic system assists in the conversion of solar energy into electrical energy. Each solar panel is made up of small photovoltaic or solar cells that are generally made up of silicon or any other semiconductive material that consists of three layers. When sunlight strikes the solar cells it causes the electrons to come loose and creates 'holes' or vacancies. Then in the electric field, the electrons in the p-type (as shown in the figure) will jump crossing the barrier to the n-type and escape out in the circuit causing the current to

flow. However, this electricity produced is Direct Current (DC) which is directed to the central inverter that converts it into Alternating Current (AC) which is further transferred to the switchboard to be used by the household. On cloudy days and overnight, The solar panels might not be able to capture enough sunlight to use for energy; conversely, within the middle of the day, they will collect plenty of energy—more than one would need. Thus a meter is installed to monitor the electricity flowing to and from the house Solar power plants have been installed by

Pros and cons of solar energy

Solar energy comes with varying advantages, but one major element that stands an edge over other resources is its profusion. There is no way life can sustain itself without the sun, its rays can be trapped in every part of the world to produce desired energy. Solar power doesn't just serve one purpose, it can be applied diversely i.e. it can generate electricity by photovoltaic phenomenon or produce heat and act as a solar water heating structure. These solar plants once installed require a negligible amount of maintenance and come with a lifespan of about 25 years thus it is just like a one-time investment and relieves the individual for life. Since the panels remain stationary, the chances of any wear and tear in their system decline. Moreover, such a system helps in lowering the exorbitantly high electricity bills provided a major part of the energy requirements are met through the generation made by solar plants. Also if the grids are interconnected, the surfeit energy can be transferred back to the power company. At times when the weather is not suitable, energy stored in the battery facilitates a few hours of electricity supply, which is another benefit associated with it. This no greenhouse gas emission source reduces one's dependence on deleterious fossil fuels and assists in combating the perennial issue of climate change. All the technical work required- that ranges from manufacturing to assembling, installing and maintenance of solar panels generates jobs contributing to the

various countries worldwide where China is the leading user of solar power globally. Besides China, many other countries such as the United States, Germany, Japan, Vietnam and also India are incorporating solar panels to meet their energy requirements. There are many projects that organisations in India are taking up to incorporate solar energy. Recently it was seen that in collaboration with IIT Mumbai, the Indian army had launched its first green solar plant in Sikkim to comfort its troops working in harsh situations and remote areas.

economic development of the country. Continuous developments in the technology of the solar power industry are only increasing its efficiency and making it all the more versatile such that its usage can expand Just like the two sides of a coin, solar energy comes with its cons. Where maintenance of such a system is low, its initial set up cost is high as one needs to purchase various items like solar panels, batteries, inverters and further pay huge amounts to get it installed. Its weather dependence nature creates difficulties in the path. During cloudy or rainy season or night time, the functioning of solar panels gets affected since it is entirely dependent on sunlight leading to the requirement of a large battery bank which is again extremely expensive. These systems require large space depending on the size of the energy that one is trying to produce. The main motive is the collection of as much sunlight as possible which requires large solar PV panels to be installed using up the majority of the space. In comparison to other sources, the pollution caused by solar energy is relatively less but it is associated with the emission of greenhouse gases. The manufacturing of photovoltaic systems is done using some toxic and hazardous products making it a trivial element harming the environment. These systems are more suitable in generating small scale power, however, with technological advancements such concerns are being met.

Case study of a village in Madhya Pradesh

We have witnessed numerous talks of air pollution primarily in the cities and around, but what about the emissions from the traditional stove that chokes and leaves women crying due to the smoke every day. A study by the United Nations Environmental Programme has shown that about 50% of India's pollution has been caused due to the use of traditional cooking

stoves that are made by burning solid substances like wood, cow dung etc. By-products of burning such substances are hazardous gases like nitrogen oxides and carbon monoxide taking a toll on the health of people exposed to these fumes which colossally are women and children. Destruction of trees to gather all solid substances is another critical issue raised on its use making

it a significant contributor to climate change. Similar was the condition of a village named Bancha in Betul district located around 150 km away from Bhopal, the capital of Madhya Pradesh. Each family residing there would travel long distances to collect wood from forests as depending on traditional stoves was their only solution. However, the government made certain attempts to influence such households to shift to cleaner fuel. One is the Pradhan Mantri Ujjwala Yojana- by incurring an expenditure of Rs 80 billion, the women belonging below the poverty line were to be provided with LPG cylinders with a motive to make rural India free of smoke and generate alternatives to address the health-related concerns of women. However, in Bancha, some tribal families didn't receive the benefit and the ones who got weren't able to continue for a prolonged period due to the financial crunch imposing restrictions on refilling the cylinders. Thus, an initiative was taken, nonetheless, the motive associated with welfare couldn't be experienced by this village, pushing the villagers to their former method. Their misery, however, didn't last that long, Mohan Nagar a member of "Vidya Bharti Shikshan Sansthan" an NGO in Betul district, put in all possible efforts to uplift village Bancha of their affliction by mobilizing natural resources. The initiative was put in action by collaborating with IIT-Bombay students and Oil and Natural Gas Corporation (ONGC) in the year 2017. Under the Solar Urja Lamp project, students worked on producing inductions that operate on solar power with the financial assistance provided by the ONGC which was Rs 89,43,000 as stated by ONGC in one of its reports. Since the residents of the village were unaware of the functioning of cleaner fuels, the organisations

involved themselves in various aspects ranging from influencing residents to adopt electric stoves to setting up all appliances. The installation of solar panels which gather sunlight and convert it into electricity, batteries which act as current storage, charge controller, MCB which acts as a supplier of electricity and kitchen appliance - the induction which assists in making food for the family members in all the 74 households of the village was completed by December 2018. The results made every resident extremely content, every penny and the amount of time spent was worth it because a lot of problems that were earlier faced by the villagers are now resolved. The residents now have to no more travel miles to collect forest wood and the time saved is utilized in productive work. Women are all the more relieved as with the installations of solar inductions the food is cooked much faster without causing any irritation in their eyes, which earlier the smoke used to cause. Youngsters who were unable to devote time to their studies, now no longer compromise with their education, emphasizing their baby steps towards upliftment. At times when there is no electricity, the energy generated from the solar panels acts as a great back up. Relaxation from high electricity bills and economic aid that comes with it is another benefit enjoyed by the villagers. The village has become pollution-free, making the villagers free from all the diseases caused by pollution. All the houses of this remote tribal village now have solar kitchens, making it India's first solar kitchen village and leaving an imprint for others to follow this revolutionary path of increasing the usage of renewable and sustainable resources.

Conclusion

This unstoppable trajectory of solar power is evidence of it being assimilated all around the world. It has come a long way with persistent developments in its use. With increased subsidy regimes and projects undertaken by the government, its scope has only been widening. Moreover, advanced technologies are guaranteeing an improvement in its efficiency and covering one of its important con i.e. high initial cost by opting low priced gadgets to

decrease manufacturing cost. One major trouble of such energy sources is their incompetency to produce as much electricity as fossil fuels. Thus, if the promise of these innovations to generate better power is met then it can become a substitute rather than an alternative with the additional benefit of combating climate change.

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