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ENGINEERING TOOLS FOR RURAL INDIA: A REVIEW

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Abstract

Engineering education is mainly a technical education. The role of the engineer and engineering education in addressing the issues of electricity, water, shelter, site planning, infrastructure, food production and distribution, communication, poverty and human welfare has been rather limited in rural India. It is therefore doubtful whether human welfare could be optimized through engineering education and practice in India for current and future generations. The presence of solar energy at any location in a village or on a farm makes its use attractive for such an environment. This paper briefly explores the development and deployment of innovative solar power based systems. This paper describes the various innovation in solar field such as solar power well, solar power centralized food preservation facility, solar powered vehicles, solar powered waste management, solar power booster for mobile communication, solar powered rural homes/huts, etc. The main objective for this paper is to provide advanced solar equipment in such a manner that it must be cost efficient and easily available for rural people. The examples of technologies that are in need of solar power for rural areas include home appliances, farm implements, waste management and crop transport. Today, for an increasing number of power needs, solar cell electricity is the cheapest and best way to generate electricity. The end result of this effort is the identification of the final design and manufacturing process.

Index Terms: *Rural India, Solar Power, Technology.*

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1. SOLAR TECHNOLOGY

Solar power is a form of energy harnessed from the power and heat of the sun's rays. It is renewable and therefore a "green" source of energy. The most common way of harnessing energy from the sun is through photovoltaic (PV) panels- those large, mirror-like panels, you've likely seen on roof tops, handheld solar devices and even space crafts. These panels operate as conductors, taking in the sun's rays, heating up and creating energy (and electricity).

On a larger scale, solar thermal power plant also harnesses the power of the sun to create energy. These plants utilize the sun's heat to boil water and, in turn, power steam turbines.

These plants can supply power to 1000s of people.

Every hour, the sun beats down with enough power to provide global energy for an entire year. It takes an average of 8 minutes for energy to travel from the sun to the earth. Scientists have used solar energy to power spaceships since 1958. Most solar panels used today have an average life expectancy of between 20 to 40 years.

Technological advances over the past couple of decades have made solar power into an efficient and affordable source of electricity, in addition to everything else the sun does for us. It makes sense to call it an alternative in comparison to burning fossil fuels or using nuclear plants.

Fig-1: Solar panel.

The more electricity we can get from the sun, the less we will have to suffer the environmental and geopolitical

consequences of these other fuels. Meanwhile, here are some interesting facts:

1. It takes about eight minutes for energy to travel from the sun to the earth.

2. British scientist John Herschel figured out how to use solar power to cook his food on an African journey he took 200 years ago.

3. Albert Einstein's experiments on photovoltaic power (which includes solar power) won him a Nobel Prize in 1921. 4.Photovoltaic cells made from the silicon in one ton of sand can produce as much electricity as burning 5,00,000 tons of coal in a power plant.

5. California gets so much sunlight that, according to a US Department of Energy report in 2000, San Francisco could supply all of its daily electricity needs by installing solar panels on the roofs of all of its government buildings and schools.

6. Germany generates solar electricity on sunny days and stores some of its in storage batteries for use on cloudy days.

7. There has been talk of placing solar panels on large tracts of desert land to generate electricity. Our power grid is not up to the task of distributing that electricity to where it is needed. Duke Energy has established partnerships with numerous businesses that provide land for smaller solar installations. Enough of those can accomplish the same purpose within the constraints of the present grid.

8. By 2009, 10,000 households in the United States went off the grid by using solar power for their homes. Power companies even buy excess electricity from these installations.

9. Short of converting an entire house to solar power, it is possible to install solar hot water heaters, shed and attic lights and ventilation and outdoor lighting. There are even solar chargers for cell phones and other modern electronic gadgets. Decorative lighting for decks and gardens that would be an extravagant waste of power from the grid become eco-friendly when they're solar powered.

1.1 Background

The presence of solar energy at any location in a village or on a farm makes its use attractive for such an environment. This direct use of solar energy continues while modern technologies have made the rural life dramatically different. The examples of technologies that are in use in rural India include mobile phones, home appliances, farm implements, vehicles for human, animal, and crop transport. The main sources of energy for these are electricity, gas, and petroleum. The burning of wood and other materials for multiple uses continues. The cost and reliability for the supply of these energy sources has been a source of concern throughout rural India. The environmental impact from their use has also surfaced as a major concern.

2. NEED OF TECHNOLOGY IN RURAL PLACES

The applications of solar power should include direct utilization of light, direct utilization of heat, and transfer of solar energy into electric power. The following are the possible needs based on our observations and experience in rural communities of India .These needs were originally stated below:

1. **SOLAR VEHICAL:** Solar vehicle is an electric vehicle powered completely or significantly by direct solar energy. Usually, photovoltaic cells contained in solar panels convert the sun's energy directly into electric energy. The term solar vehicle usually implies that solar energy is used to power all or part of vehicles propulsion. For fast transportation of materials, crops, animals, and humans, rural areas now depend on vehicles that run on gas/petrol or are pulled by animals. These vehicles could be designed to run on solar power.

Solar power may be also used to provide power for communications or controls or other auxiliary functions.

2. **SOLAR POWERED PUMP:** A solar powered pump is a pump running on electricity generated by photovoltaic panels or the radiated thermal energy from collected sunlight as opposed to grid electricity or diesel run water pumps. Solar pumps are useful where grid electricity is unavailable and alternative sources (in particular wind) do not provide sufficient energy.

3. **SOLAR POWER CENTRALIZED FOOD PRESERVATION FACILITY:** Farm products degrade in normal climatic conditions. Low temperatures and humidity allows extending the usable life of these products. Storages with compartmented design can be built in rural areas and their environment regulated with solar technology. These storages can be built through village cooperatives and then rented to farmers for their use. Food preservation will greatly help to satisfy India's growing demand.

4. **SOLAR LIGHTED STREETS:** Solar street lights are raised light sources which are powered by photovoltaic panels generally mounted on the lighting structure or integrated in the coal itself. The photovoltaic panels charge a rechargeable battery, which powers a fluorescent or LED lamp during the night. Most solar panel turn on and turn off automatically by sensing outdoor light using a light source. Solar street lights are designed to work throughout the night. Person can stay for more than one night if the sun is not available for a couple of days.

5. **SOLAR POWERED WASTE MANAGEMENT:** The various hazardous problems caused due to waste produced from farms can be overcome by using solar powered compressors. These products would benefit immensely the rural communities.

6. **SOLAR POWER BOOSTER FOR MOBILE COMMUNICATIONS:** Solar Power is directly tapped at each transponder location and converted into RF energy which contains the signals that are trafficking through the transponder. This RF converted solar power can be used to complement/supplement the power that is available through the traditional power grid. Thus, each ground transponder will be equipped with solar panels and conversion electronics.

Fig-2: Small business owner checks his electricity consumption.

Fig-3: Stitching under smart power lamp.

2.1 FUTURE DEVELOPMENTS:
For future development we must implement the following:
1. Solar technical trainings.
2. Solar charging stations.
3. Solar workshop in schools and colleges.

Our approach is to develop systems that satisfy a need and have a future in rural India. That implementation includes: System level approach, technology need study, Cost-effectiveness Study, Continuous New Development and Improvement.

2.2 DESIGNING OF SOLAR PANEL:
Designing of solar are classified on the basis of folding of solar panel and are given as-

1. Foldable solar panel design.
2. Unfoldable solar panel.

1. Foldable Solar Panel:
A foldable structure was designed for the solar charging system. The prototype consists of nine solar panels, connected together in such a way that when folded, it forms a cubical structure. The advantages of folded solar panels are – it is simply made, high production efficiency, more flexible, easy to pack, store and use, more selective, low production energy loss, etc. The greatest advantage of the new folding panel design is, cells are still able to work normally if one of the cells stops working.
In folded configuration, the battery and the controllers are covered with panels from all sides, hence making this system suitable for rugged use. It gives higher power output than a solar panel of same area; In-built space to store battery and controller with no external protection requirements; Easily portable due to compact size; Each part of the design can be individually replaced in case faults occur; and Durable and rugged structure ensures a long life for the overall system.

Fig-4: Foldable solar panel

2. Unfoldable Solar Panel:

In the unfolded configuration, the panels attached to the square ring are raised to the top. The space under the central panel is used to store the battery and the controllers for the panels.

Fig-5: Unfoldable Solar Panel.

2.3 TECNOLOGICAL CHALLENGES:

Many approaches to providing energy to rural areas have resulted in diverse power utilization and in changing the mode of living of farm communities across the globe. India is no exception to this. The main challenge we see for the solar power utilization is to maintain the values and culture of the farm communities while providing solar based technology to exponentially enhance the quality of life of the inhabitants. This requires a deliberate understanding of the needs of rural inhabitants and innovative approaches to implementing and integrating solar power for their life style. Technology can break barriers, provide key skills and training, and make people feel empowered.

In rural areas the consumers find it very difficult to opt for products that are heavily dependent on steady power supply. To overcome this, it is important that companies go extra mile to install components that can endure such conditions and withstand power issue. Furthermore, costs associated with repair and maintenance should be minimal.

Weather changes have dramatic effect on the amount of solar energy that can be harvested for rural applications. For this reason, technological approaches should work in cloudy, rainy, and winter weather because the farm work continues in all seasons. This calls for a hybrid design approach which uses traditional electric power at such times.

3. CONCLUSION

The sun is a powerful source that can help our planet by giving us clean, reusable energy to power our world. The use of this energy is free, does not create pollution, and if used wisely can help us become less dependent on other more costly and damaging forms of power. So, our approach is to develop systems that satisfy a need and have a better future in rural India by using solar technology. The technology needs must approach through a systems level strategy. Each and every rural person must be aware about utilizing energy from solar technology.

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REFERENCES

[1]. https://www.sustainingourworld.com

[2]. https://www.rokefellerfoundation.org

[3]. Innovative solar power technology system for rural India IICI 2015, Nitin Saini, Kumar Krishen, Ph.D.

[4]. https://www.justenergy.com

[5]. Wikipedia