A REVIEW PAPER ON SOLAR ENERGY FROM SOLAR PANELS TO SOLAR SKINS

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ABSTRACT

Sun energy is the most abundant energy available on earth. Over the years with advances in technology solar energy has emerged as most useful renewable sources of energy. Solar energy has evolved from ground mounted solar panels to wearable solar panels and solar tracking mounts. But there are now several exciting new solar panel technologies either in the pipeline or already on the market. These promising technologies will revolutionize the way we think about not just solar, but energy production in general. Solar no longer requires large parcels of land or roof space, nor does it need to look boring. Silicon panels are becoming cheaper and more efficient day-by-day. According to experts, if photovoltaic panels are placed on reservoirs and other water bodies, they offer even greater efficiency as well as a plethora of other benefits. Innovation in solar technology continues to improve efficiency, size and cost, making it more pervasive throughout society. The trend is leaning toward incorporating solar into more buildings beyond panels placed upon the roof. Cool applications include: solar shingles, solar film, solar roadways, and solar windows. Other innovations being explored are: the solar orb, solar cars (commercially available), solar balloons, nanowires, and working with the infrared spectrum. As the manager of the Green Mountain Energy Sun Club, I'm excited about these advances in solar technology and the growing part this pollution-free resource will provide in our lives. A solar future is closer than you may think. Technology for producing electricity from the sun using solar cells, typically encased in panels.

Keyword : - *solar panels, photovoltaic, solar cells.*

1. INTRODUCTION

Sun has massive energy and is being used to produce electricity over the years. Solar energy has become the major source of renewable power generation as well as source of employment. Solar processes use photovoltaic effect to convert sunlight to electricity. Photovoltaic effect was discovered by French scientist Edmond Becquerel in 1839. On April 25,1954, Bell scientists presented a solar panel of cells that relied exclusively on light power and used to run a 21 inch Ferris wheel as a proof. During the 1960's and 1970's, solar panel technology was often too expensive for mainstream consumer distribution. Dr. Elliot Berman is credited for contributing to affordability of solar panels in mainstream market. As the space age developed, solar panels were used to power various parts of spacecraft throughout the late 1950s and 1960s. The first was the Vanguard I satellite in 1958, followed by Vanguard II, Explorer III, and Sputnik-3.In 1964, NASA launched the Nimbus satellite, which ran entirely on its 470-watt photovoltaic solar panel array.[6] It wouldn't be long now until solar energy's potential moved from outer space to homes and businesses on planet earth. Solar cell improvements based on Becquerel's initial uncovering of the photovoltaic effect brought early solar panels to about 1 percent efficiency and around $300 per watt. It cost about $2 – $3 per watt to generate electricity from coal at the time. Bell Labs' 1954 silicon solar cells operated at around 4 percent efficiency and later achieved 11 percent efficiency. This was a significant increase that enabled powering an

electric device for several hours for the first time in history. Then in 1959, Hoffman Electronics achieved 10 percent efficiency. Soon after, they beat their own record with 14 percent efficiency in 1960.These efficiency upgrades helped push solar panels into the space program. The use of solar panels in the space program through the 1960s increased production and slowly the price reduced to around $100 per watt.

Currently, solar panels average between 15 and 18 percent efficiency and can cost as low as $0.50 per watt. Since its inception, solar power technology has made constant progression. Advancements in photo voltaic (PV) and concentrated solar power (CSP) have produced a more effective hybrid technology for solar panel engineering, and have helped lower the cost significantly. In 2016, MIT researchers were able to produce ultra-slim, flexible solar cells that are only 1.3 microns thick. These lightweight cells are said to weigh the same as soap bubbles, allowing future opportunities for use in certain technologies like cell phones. According to MIT, "conventional silicon-based solar modules produce about 6.8 watts per pound, but these new devices can generate more than 2,720 watts per pound, https://energy.gov/eere/videos/energy-101-solar-pv 400 times as much." While this advancement is still in early phases, it could help widen the use of solar technology. There have also been ongoing efforts to make solar energy even more affordable and efficient with an emerging technology called the "perovskite" solar cell. This crystalline material could ultimately replace silicon in solar panels and reduce costs using simpler production methods.

Fig- 1: Solar panel

2. LITERATURE REVIEW

2.1 SOLAR SKIN DESIGN

One major barrier for the solar industry is the fact that a high percentage of homeowners consider solar panels to be an unsightly home addition. Luckily, one new venture has a solution. Sistine Solar, a Boston-based design firm, is making major strides with the concept of aesthetic enhancement that allow solar panels to have a customized look. The MIT startup has created a "solar skin" product that makes it possible for solar panels to match the appearance of a roof without interfering with panel efficiency or production.

Fig- 2: Solar skin

2.2 SOLAR POWERED ROADS

Last summer paved the way for tests of an exciting new PV technology – solar powered roads. The sidewalks along Route 66, America's historic interstate highway, were chosen as the testing location for solar-powered pavement tech. These roadways are heralded for their ability to generate clean energy, but they also include LED bulbs that can light roads at night and have the thermal heating capacity to melt snow during winter weather. The next stop following sidewalk tests is to install these roadways on designated segments of Route 66.

Fig- 3: Solar powered Roads.

2.3 WEARABLE SOLAR

Though wearable solar devices are nothing new (solar-powered watches and other gadgets have been on the market for several years), the past few years saw an innovation in solar textiles: tiny solar panels can now be stitched into the fabric of clothing. The wearable solar products of the past, like solar-powered watches, have typically been made with hard plastic material. This new textile concept makes it possible for solar to expand into home products like window curtains and dynamic consumer clean tech like heated car seats. This emerging solar technology is credited to textile designer Marianne Fairbanks and chemist Trisha Andrew.

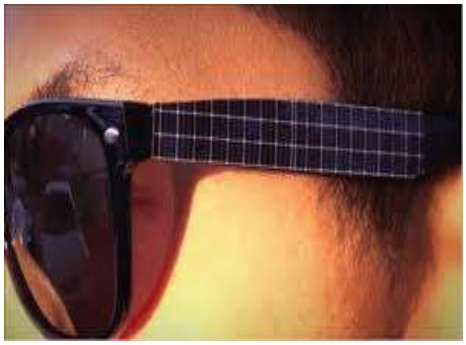

Fig- 4: Solar wearable.

Fig- 5: Solar wearable.

2.4 SOLAR BATTERIES: INNOVATION IN SOLAR STORAGE

The concepts of off-grid solar and solar plus storage have gained popularity in U.S. markets, and solar manufacturers have taken notice. The industry-famous Tesla Powerwall, a rechargeable lithium-ion ion battery product launched in 2015, continues to lead the pack with regard to market share and brand recognition for solar batteries. Tesla offers two storage products, the Powerwall 2.0 for residential use and the Powerpack for commercial use. Solar storage is still a fairly expensive product in 2019, but a surge in demand from solar shoppers is expected to bring significantly more efficient and affordable batteries to market in 2019.

2.5 SOLAR TRACKING MOUNTS

As solar starts to reach mainstream status, more and more homeowners are considering solar – even those who have roofs that are less than ideal for panels. Because of this expansion, ground mounted solar is becoming a viable clean energy option, thanks in part to tracking mount technology. Trackers allow solar panels to maximize electricity production by following the sun as it moves across the sky. PV tracking systems tilt and shift the angle of a solar array as the day goes by to best match the location of the sun. Though this panel add-on has been available for some time, solar manufacturers are truly embracing the technology. GTM Research recently unveiled a recent report that shows a major upward trend in the popularity of tracking systems. GTM projects a 254 percent year-over-year increase for the PV tracking market this year. The report stated that by 2021, almost half of all ground mount arrays will include solar tracking capability.

3. THE FUTURE OF SOLAR

Solar power was earlier generated only by means of ground-mounted or rooftop panels. But thanks to all the advancements mentioned above, solar is set to become lighter, more flexible, and applicable everywhere.
Imagine all this tech is available and you visit another city. You can buy food at a solar-powered food cart, eat it while traveling on a solar-powered highway, and charge your phone from your solar-powered clothes. This is what the near future looks like! And there are actually lots of other innovative residential solar technologies in development or currently being rolled out in 2020.

4. CONCLUSIONS

Solar power is an immense source of directly useable energy and ultimately creates other energy resources: biomass, wind, hydropower and wave energy. Most of the Earth's surface receives sufficient solar energy to permit low-grade heating of water and buildings, although there are large variations with latitude and season. At low latitudes, simple mirror devices can concentrate solar energy sufficiently for cooking and even for driving steam turbines. The energy of light shifts electrons in some semiconducting materials. This photovoltaic effect is capable of large-scale electricity generation. However, the present low efficiency of solar PV cells demands very large areas to supply electricity demands. Direct use of solar energy is the only renewable means capable of ultimately supplanting current global energy supply from non-renewable sources, but at the expense of a land area of at least half a million km.

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