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MICROWAVE-BEAMED SPACE-BASED SOLAR POWER FROM CUBESATS TO POWER HOUSEHOLDS IN REMOTE AREAS AND IN CITIES WITH DENSE CLOUD COVER

Abstract

Amidst the increasing rate of global warming and its adverse effects and threats, such as extreme weather events, hurricanes, heat waves, flooding, droughts, wildfires, and landslides, the demand for a reliable, sustainable, and cost-effective global energy source is soaring. While Solar Energy proved to be the most dominant and efficient energy source on the planet, it is still not the most reliable in several cities with dense cloud cover, and extremely few hours of yearly sunshine, around the globe. Major developed cities and capitals in Europe and Asia receive less than 2000 hours of sunshine per year. Cities like Seattle and Portland in the US have more than 60 days of heavy clouds during winter. On the other end of the spectrum, a little under 1 billion people, in remote places and developing countries, have no access to electricity.

Commercial single-junction solar cells' efficiencies range from 14% to 23%, while the highest multi-junction solar cells' efficiency was 44% in 2018. Typically, best residential solar panels produce 290-360W of power at Standard Testing Conditions (STC). Hypothetically, a 1KW panel will not be enough to supply a quarter of the power a household in Canada, the US, or Europe needs per day, but the same panel would be enough to power the same household when placed in space. In a city where Solar Irradiance (SI) or insolation (i.e. number of peak sunshine hours) is 2-4 hours a day, solar power cannot be considered as a primary and reliable source of energy. The three factors determining this are the SI or insolation, the efficiency, and the surface area of the panels.

Therefore the question is whether solar power can be "**Beamed**" efficiently from space. To commercialize SSP, certain aspects need to be thoroughly addressed and improved, such as the conversion efficiencies, the size and cost of the rectenna, the size, cost, and amount and type of power output of the satellites, and the health and safety hazards. This paper addresses current shortcomings of solar energy and provides an innovative solution to the challenges referred to in previous research papers from technical, economic, and social perspectives. It also investigates Space-based Radioisotope Thermal Generators (RTGs) to maximize power output. Microwave-beamed Space-based Solar Power (SSP) has the potential to transform and disrupt the global energy sector and implement UNSDG 7&13. This will eventually create a cleaner, more efficient, cost-effective, abundant, and reliable energy source.