

The Feasibility of Space Solar Power

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Abstract

A comparison is made of Space Solar Power (SSP) satellite concepts using microwave and laser transmission technologies, to ground-based solar power generating facilities using photovoltaic (PV) and concentrating solar power (CSP) technologies. All solar power systems were analyzed by showing the efficiencies of each at every phase of the process from solar energy radiance by the Sun at 1 AU to conversion and transmission as electrical energy into the power grid on the Earth's surface. Further analysis examined the area required for the SSP space based collectors and the area requirements of the ground collectors for all the systems. From this collection of information observations could be made on overall practicality of the various systems. The original intent of the study was to find a feasible scenario for the collection of power in space for use on earth that would be reasonably competitive with earth-based solar energy systems and to then prepare a flight demonstration concept. Findings indicate that ground-based solar power generation outperforms SSP in all factors considered in this study. A flight demonstration to generate SSP for transmission to Earth, may provide data and insight into the development of similar systems that could be useful on other worlds, such as the Moon or Mars. Other conclusions indicate that existing terrestrial CSP systems outperform SSP in end-to-end efficiency and large CSP installations can have the same advantage that SSP boasts for 24-hour power production.