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Space-Based Solar Power Architectures / Space & Energy Concepts (1)

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NEW DEVELOPMENTS IN SPACE SOLAR POWER

Abstract

In December 2015, the great majority of Earth's nations, recognizing the urgent need to mitigate the looming risks of climate change, announced ambitious goals for the reduction of CO2 emissions this century. At the same time, global demand for energy continues to expand with increasing populations and the need for improved economic conditions in all countries. In the judgment of many experts, these potentially-conflicting goals are unlikely to be accomplished solely through the use of already-existing technologies (such as hydro, terrestrial solar and wind power). Among other important options, Space Solar Power (SSP) remains one of the most-promising, but as yet largely undeveloped options to accomplish this goal. During 2008-2011, the International Academy of Astronautics (IAA) accomplished the First International Assessment of Space Solar Power, involving diverse subject matter experts (SMEs) from some ten (10) countries. The IAA assessment found that SSP is technically feasible and that it might be realized in as little as 10-15 years.

Following on those results, in 2011-2012 an international team, working under the auspices of NASA's Innovative Advanced Concepts (NIAC) program examined a novel, more practical hyper-modular approach to realizing SSP: "SPS-ALPHA" (Solar Power Satellite by means of Arbitrarily Large Phased Array), invented by the author. Together, the IAA and NIAC studies framed the foundation of an integrated treatment of the topic, "The Case for Space Solar Power" (published in 2014), which presented the first single-volume, integrated and detailed discussion of the topic in some 20 years.

In the past several years, new ideas for SSP in general and improvements in the SPS-ALPHA concept in particular have emerged. These include related developments in space and terrestrial technologies (e.g., reusable launch systems), new SSP activities internationally (e.g., new commercial efforts), as well as innovations in how SSP might be accomplished (e.g., in-space fabrication). The potential impact of these innovations on the economics of SSP have been analyzed and compared to terrestrial energy options to meet climate change goals. This paper will review these recent events in the SSP sector, focusing on an evaluation of the potential impact of new technologies and resulting concept evolution on the technical feasibility and economical viability of space solar power.