IAF SPACE POWER SYMPOSIUM (C3)
Solar Power Satellite (1)

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TOWARDS SUSTAINABLE SPACE-BASED SOLAR POWER: ASSESSING A MODULAR APPROACH INTEGRATING IN-SPACE MANUFACTURING AND SPACE RESOURCES

Abstract

The utilization of space-based solar power (SBSP) represents a promising pathway for sustainable energy generation across diverse applications, necessitating innovative approaches for efficient solar energy harvesting. This assessment provides a preliminary evaluation of a scalable and modular SBSP concept based on the International Planetary Sunshade (IPSS) system, which integrates the utilization of space resources and in-space manufacturing techniques. Based on the IPSS system modeling, a scalable and modular SBSP concept has been developed enabling flexible adaptation to application-specific requirements. The key focus lies in the investigation and characterization of manufacturing processes for the integration of SBSP-relevant components into the in-space manufacturing and assembly facility concept. This analysis provides valuable insights for integrative and flexible production. In addition, a comprehensive energy analysis and cost estimation have been conducted across various application cases. The findings indicate the potential of the presented modular and scalable concept for delivering cost-effective SBSP solutions. In summary, such a modular and scalable concept is a promising addition to existing SBSP approaches, offering the opportunity to develop application-specific solutions based on a modular platform that are both economically viable and sustainable. Furthermore, the synergy between the IPSS system and the developed SBSP concepts not only supports climate mitigation strategies but also facilitates the required energy transition. Additionally, it unlocks the potential of a flexible energy infrastructure for space exploration, opening up new horizons for human spaceflight.