

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

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PROPOSAL OF THE FIRST KOREAN PILOT SYSTEM FOR SPACE BASED SOLAR POWER(SBSP)

Abstract

The energy transition to “Carbon Net Zero” becomes a big challenge to all the countries. Korea also declared “Carbon Net Zero by 2050” as a national vision and released an execution scenario even though Korea is not a good country for renewable energy generation due to small territory and less favorable climate environment with somewhat high latitude for terrestrial solar power. For relief, nuclear energy could be considered since European Union recently categorized nuclear energy as the green taxonomy. However, European Union imposed two prerequisites, such as use of accident tolerant fuel and secure of high-level radiation waste repository, on nuclear energy to be recognized as green energy. In fact, it is not easy for any country to meet both prerequisites at present time. Above all, positioning a high-level radiation waste repository in Korea will raise national disputes. Under these circumstances, securing regeneration energy from SBSP could be a breakthrough to achieve the goal of “Carbon Net Zero by 2050” in Korea. However, despite the many advantages of SBSP, there are still technical and economical difficulties to overcome before the SBSP is realized in space. As a latecomer in the field of SBSP, Korea released the conceptual design of Korean space solar power satellite at IAC 2019 and recently demonstrated 50m distance wireless power transmission(WPT) on the ground. Since it takes considerable time and budget to develop a Giga watt class commercial SBSP system, as a first step, it is proposed to demonstrate possible system level technology in space by integrating the available technologies even though they are not sufficient. Considering the budgetary availability and domestic technology readiness in Korea, two micro/small satellites are proposed as a space test platform to demonstrate the power transmission in space. Obviously one satellite will act as an electric power transmitter and the other one as a receiver. In fact, in order to accommodate the ground WPT module to space applications, lightweight design, expendable/deployable antenna design and performance improving methods are to be developed. For the bus side, expendable/deployable structure design for solar array, high voltage/high power management system, formation flight and satellite operation concepts are to be developed. Finally, the specifications of two satellites are defined and the efficiency of electrical power transmission are estimated such that these outputs would be used as design references and operation guidelines when this pilot project is realized in Korea within 2020s.