

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

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## MODIFIED INTRODUCTION SCENARIO FOR PRACTICAL SPS IN JAPAN

**Abstract**

We are re-examining a system of the solar power satellite (SPS) that converts solar energy into electricity in space, and transmits energy by wireless power transmission (WPT) from space to the ground. The SPS has been studied for half a century. In the 1970s, NASA and DOE designed and proposed several kilometers of giant space segments that can transmit GW power. This system had a 1 km onboard power transmitting antenna, under which conditions the size of the ground segment was about 10 km. Due to its low loss transmission characteristics in the atmosphere, 2.45 GHz microwave was selected for WPT. And the geosynchronous orbit was selected. End of the 90's, many types and conditions of the SPSs were studied in the US. Low earth orbits were considered for some types of the practical SPSs. Also, in the '90s, SPS2000 was studied in Japan. The main purpose of this study was to clarify what SPS was, and the focus of its research activities was on feasibility. The space segment with a WPT system of around 10 MW, and with a size of several hundred meters was designed, and a low earth equatorial orbit at an altitude of 1,100 km was chosen. SPS2000 is considered a pilot plant because it can supply meaningful power to the ground and has all the functions of SPS. In 2000s, the GW-class SPSs for commercial utilization were designed in Japan. Geosynchronous orbit was chosen. A 5.8 GHz microwave higher than 2.45 GHz was adopted for WPT to reduce the size of the space segment and ground segments. Geosynchronous orbit is useful not only for communications, broadcasting and weather forecasts, but also for the SPS. Because geosynchronous orbit is so far away, using geosynchronous orbit increases launch costs and increases the sizes of the SPS. Therefore, we are re-designing the orbits and antennas of the SPS for the demonstration phase, the pilot plant and the practical SPS from viewpoint of the size of the SPS, the area and location of ground segments, launch cost and constellations of the space segments. This study considers the situations in Japan where it is difficult to secure a large area, which is long in the north and south and short in the east and west. We will describe the engineering system study of the SPS and social and diplomatic meaning including the development process and the practical SPS.