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SPACE POWER SYMPOSIUM (C3)
Space-based Solar Power Architectures – New Governmental and Commercial Concepts and Ventures (1)

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UPDATED TECHNOLOGY ROAD MAP FOR SOLAR ENERGY FROM SPACE

Abstract

The global problem, combined with CO2 issue and shortage of natural energy resources, needs to be resolved in the latter half of this century for human sustainability. Considering the climate inertia and the leading time for new energy infrastructure, the "solar energy from space" is expected to be realized in the time frame 2030-2050. Referring to the history of nuclear power plant as an innovative energy system, it will take 20-25 years for the Space Solar Power Systems (SSPS) from the initial system verification to the first commercial model. That means we are requested to complete the initial SSPS system verification within several years from now, the system-level demonstration in 10 years, and the plant-level demonstration in 20 years. Following the scheme, one of the current SSPS models, the updated reference microwave concept, the sandwich microwave concept, or the laser concept, will be in operation as the first commercial system around 2035. To realize this scenario, we have developed an updated road map for the SSPS technology development. In Japan, we already started preparation of wireless power transmission experiment at 1 kW level on the ground both for microwave and laser. The ground demonstration will be completed by the end of 2013. After the ground experiments, small-scale microwave and laser power transmission experiments in orbit will be conducted around 2016. Small satellites and/or JEM (Japanese Experiment Module) on the International Space Station are the possible platforms for the initial SSPS system verification. After completing the verification experiments in space, we will be able to select the configuration of the commercial SSPS. The expected power cost and public acceptance will be the major trade off factors for the selection. For the selected model, we will conduct the system-level demonstration at 100 kW in space around 2020, using the conventional expendable launch vehicle. All basic technologies required for the commercial SSPS will be verified at this stage. The plant-level demonstration will be planned at 10 MW level and then at several hundreds of MW level in 2020's. The power from the plant-level SSPS will be delivered to the consumers to demonstrate its reality. Reusable launch vehicles are required for the latter half of the plant-level demonstration. This road map guaranties the start of construction of 1 GW class commercial SSPS early in 2030's.