

SPACE POWER SYMPOSIUM (C3)

Space-Based Solar Power Architectures – New Governmental and Commercial Concepts and Ventures (1)

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United StatesPUBLIC/PRIVATE FINANCING MODELS OF A MULTI-MEGAWATT SPACE SOLAR POWER
PILOT PLANT BASED UPON THE SPS-ALPHA CONCEPT**Abstract**

The first commercially operational Space Solar Power (SSP) system for Earth use could be a multi-megawatt (1-20 MW of delivered power) space to ground demonstrator referred to here as the First Revenue Satellite (FRS). Such a satellite would demonstrate not just the end-to-end technical readiness of SSP as a system, but also the operational readiness and revenue generation potential for specific customers (government or commercial) over multiple years. In one potential scenario, after the initial government funded end-to-end demonstration phase, the system would be turned over to commercial operators for public/private service. This is deemed to be a more feasible and useful mid-scale demonstration of SSP. Niche markets (e.g. military installations, developing nations) may be targets of opportunity for an economically viable service, given certain government support and Earth-to-Orbit launch cost assumptions. Results of financial modeling using the CABAM-2 simulation tool of a hypothetical commercial company attempting to operate such a pilot plant is provided here. The SSP satellite system being modeled is based upon a new hyper-modular architecture referred to as SPS-ALPHA (Solar Power Satellite-Arbitrarily Large PHased Array). SPS-ALPHA is a biologically inspired concept: in a manner analogous to a hive of bees, a large number of individual modules (each individually “intelligent”) will physically assemble to form a single enormous satellite. To deliver energy to Earth, SPS-ALPHA would typically be based in a Geostationary Earth Orbit (GEO), where it would intercept sunlight using a collection of individual thin-film mirrors, convert that sunlight across a large RF aperture into a coherent microwave beam and transmit it to targets on Earth. The system is delivered to orbit through a 1-2 launch campaign utilizing near term launch vehicles such as the SpaceX Falcon 9 or Falcon Heavy. A pre-existing technical concept design of a MW-class SPS-ALPHA system is used as the baseline product line in the financial analysis to generate output metrics such as Net Present Value (NPV). Various government contribution scenarios in the life cycle of the project are examined along with their impact on overall commercial financial return. This allows comparison to determine the optimum mix of public and private financing that could enable an SSP FRS. Given future constraints on public and private space budgets, joint public/private financing of an SSP pilot plant may be a more realistic way to demonstrate both technical readiness (desired by government investors) and long term operational revenues (desired by commercial investors).