SPACE POWER SYMPOSIUM (C3)
Space-Based Solar Power Architectures / Space & Energy Concepts (1)

Author: Dr. Matthew Dalton
Sonaca Space GmbH, Germany, matthew.dalton@activespacetech.eu

SPACE BASED SOLAR POWER IS FOR MARS

Abstract

Space Based Solar Power (SBSP) was first proposed by Isaac Asimov in 1941 and has been under active research since the 1970's. While solar irradiation is around 30% higher in orbit, the main advantage of SBSP is the nearly 100% duty cycle, giving a factor of 2 to 3 improvement over ground based solar power under the most ideal surface conditions, but closer to 10 to 100 improvement compared to more realistic surface solar collection conditions. Elon Musk famously proclaimed SBSP dead with the statement "You'd have to convert photon to electron to photon back to electron. What's the conversion rate?" However, even with conversion efficiency as bad as 10% in those last two steps, SBSP still has a small advantage in power production per square meter. The biggest obstacle to technology adoption is actually the cost of launch, which can be many thousands of Euros per kilogram, and the very expensive design, development and verification campaigns involved in space missions, multiplying the cost of power production by many thousands for modern low cost solar panels. Additionally, many unresolved issues of interference with Earth communication systems exist. On the other hand, on Mars, all of these disadvantages are turned on their head. Landing equipment safely on Mars is extremely difficult and expensive. Every additional kilogram to be landed on Mars requires extra fuel which requires extra fuel for the Earth launch. By modularizing the mission into in-space power production and on-surface power consumption, the cost of the mission is significantly reduced as is mission risk. Additionally, the major problems of dust and frost collection on rover solar panels is eliminated and the possibility to maintain limited operations during the Martian winter becomes plausible. Since rectenna have far less mass than any form of on-surface electrical production, power consumption from roving would be reduced. Since solar panels in orbit can last a decade or more, SBSP units could serve multiple missions on Mars over their lifetime, with surplus power sold to third parties. Finally, the SBSP units can serve dual functions as data up-links and navigation systems. Currently, the FCC places no restrictions on bandwidth usage on Mars, meaning that Mars is the perfect location to prove/showcase the major economic and engineering advantages this technology has on planetary bodies other than the Earth. It is not time to stab SBSP in the heart, but to move the focus to another world.