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REAL OPTION ANALYSIS OF A PRIVATELY-FUNDED SPACE BASED SOLAR POWER VENTURE

Abstract

First described by Glaser (1968), Space Based Solar Power (SBSP) is a technological concept that aims to transform solar energy in space into electricity on earth. SBSP has been idealized as a clean, abundant and cost-conscious form of future energy. While it is rather straightforward to conceptualize the clean and abundant descriptors, financial viability has been elusive. Over the last 40 years many studies have modeled the economics of SBSP and have concluded that the SBSP concept is economically unfeasible due to large development and production costs and high technological uncertainties (power production, electricity to RF conversion, assembly in space) and market uncertainties (energy prices, launch costs, geopolitical risks).

Our study makes two contributions to the existing literature analyzing the business case for SBSP. First, as opposed to most existing studies that analyze hypothetical large-scale (1 gigawatt power) SBSP systems, we present detailed technology development and funding plans anchored on a small-scale (5 megawatt power) SBSP concept developed by an existing startup company (Heliosat) and its partners. Heliosat and partners plan to operate in three markets that are usually not considered in existing studies: power for space radar, power for military forward operating bases (FOB), and peak power for civilian markets.

Our paper makes a second contribution to the SBSP business case literature by developing an integrated decision trees and real option analysis to account for managerial flexibility in responding to resolution of uncertainty. The decision tree analysis part of the model incorporates the major technological sources of uncertainty and critical events that could occur during the first five years of system development.

Our methodology offers three major benefits. It first provides an estimate of the value of flexibility and shows that while classic discounted cash flow valuation tools like net present value (NPV) understate the value of an SBSP project up to the point when its NPV is negative, the added value of real options makes the project economically attractive for private investors, which suggests that government involvement is not critical for the development of the SBSP industry. Second, the analysis of real options leads to changes in the technological design, scale of deployment, and other strategic choices that maximize the value of real options. Last, integrated real option analysis provides guidance what optimal decisions to make in the future – under what conditions to increase capacity, when to abandon, and when to enter new markets.