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DEVELOPMENT (D3)Strategies & Architectures as the Framework for Future Building Blocks in Space Exploration and
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SPACE SOLAR POWER FOR THE MOON: AN OASIS 2045 USE CASE STUDY

Abstract

The validation of significant and accessible space resources – primarily volatiles such as water ice – in the permanently shadowed regions (PSRs) of the lunar poles has transformed humanity’s plans for space exploration in general and the Moon in particular. However, using those resources for the development and eventual settlement of Earth’s Moon will require a equivalent transformation in our thinking about energy in space. The Moon Village Association (MVA) architecture working group has been examining since 2019 the concept of the first self-sufficient lunar settlement at the south pole of the Moon: “OASIS 2045”. These studies have validated that significant new energy resources will be required to realize this vision: power for using regolith to manufacture locally landing pads, roads, pressure vessels, and more; power to mine, extract and process lunar ices obtained from the PSRs; power to support sustainable operations such as biological closed-loop life support systems (i.e., agriculture); and more.

This paper will review the energy requirements for lunar polar operations, and identify options for obtaining the needed power. It will also examine in some detail the potential to employ ‘space solar power’ – typically considered as a potential Carbon net-zero source of energy for terrestrial markets – to deliver lunar surface and cis-lunar space energy that is affordable, scalable and achievable in the coming 2-3 decades. The paper will conclude with a prospective roadmap for lunar development and settlement that might be enabled by the space solar power.