

IAF SPACE EXPLORATION SYMPOSIUM (A3)  
Moon Exploration – Part 3 (2C)

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## DESIGN OF SOLAR POWER PLANT ON THE LUNAR SURFACE

**Abstract**

The Moon being the only natural satellite and nearest to Earth, is the most studied planetary body to date. However, establishing a permanent base on the Moon is still a technological challenge. Due to a lack of atmosphere, solar arrays on the Lunar surface receive higher solar irradiance than on Earth. However, generating solar power on the Moon presents another set of challenges. Constant bombardments of solar wind, Galactic Cosmic Radiation as well as electrostatic discharges by the lunar regolith may pose constraints to identify appropriate locations for solar array deployments. Furthermore, during long lunar night periods, human settlements need efficient battery back-up subsystems to cater the manned-mission power requirements. The work presented in this paper considers the constraints in the design of solar arrays including location, orientation, type of battery bank. In a solar power plant arrangement, to capture most of the solar radiation, design of solar arrays is a primary objective. Solar array design includes the type of material for solar cells and the orientation of arrays to capture the maximum solar irradiance. In this work, probable geometries of solar array orientation are being explored. For storage of electrical power generated by arrays, the Regenerative Fuel Cell (RFC) is also discussed in this work. Above all, this work explains the design of an integrated power distribution system having battery backup charged by solar power. This system is consisting of AC and DC distribution modules so as to cater the power requirement of a crewed mission. Therefore, by doing an approximate load analysis of a manned mission, a conceptual design of a solar power plant on the lunar surface is presented. This paper is submitted under the auspices of SGAC's Space Exploration Project Group, as part of the research conducted within the T.U.R.T.L.E. Research Group.