

**Lunar Power Systems: Operational Challenges and Environmental Hazards.** M. Rose<sup>1</sup>, A. Sajadi<sup>2</sup>, M. Carbone<sup>3</sup>, and B. M. Hodge<sup>4</sup>. <sup>1</sup>CU Boulder, Megan.E.Rose@colorado.edu, <sup>2</sup>CU Boulder, Amir.Sajadi@colorado.edu, <sup>3</sup>NASA, Marc.A.Carbone@nasa.gov, <sup>4</sup>CU Boulder, BriMathias.Hodge@colorado.edu. (Contact: Megan.E.Rose@colorado.edu)

**Introduction:** The space industry is expected to establish a lasting human presence on the Moon in the coming decade [1]. A reliable and resilient electric power grid is a pivotal requirement to sustain human life on the surface of the Moon and other extraterrestrial bodies [2]. The Lunar environment introduces many novel conditions not experienced by Earth-based power systems, which will require a new approach to power system design and operation [3]-[5]. This paper describes the environmental hazards pertinent to power systems on the surface of the Moon and outlines the key planning and operating constraints of these systems. Technological and algorithmic requirements for intelligent management of Lunar power systems are discussed. Finally, potential failure modes of conventional microgrid controls in the Lunar environment are demonstrated with a DC microgrid simulation in SIMULINK.

**References:** [1] "Nasa plans to build a moon-orbiting space station: Here's what you should know," <https://www.space.com/41763-nasa-lunar-orbiting-platform-gateway-basics.html>, accessed: 2021-11-06. [2] H. J. Fincannon, "Lunar environment and lunar power needs," Springer Handbook Series Contribution, 2020. [3] A. D. Bintoudi, C. Timplalexis, G. Mendes, J. M. Guerrero, and C. Demoulias, "Design of space microgrid for manned lunar base: Spinning-in terrestrial technologies," in 2019 European Space Power Conference (ESPC). IEEE, 2019, pp. 1–8. [4] L. Johnson, "Orbital space solar power option for a lunar village," in 10th IAA Symposium on the future of space exploration: towards space village and beyond, 2017. [5] Z. Khan, A. Vranis, A. Zavoico, S. Freid, and B. Manners, "Power system concepts for the lunar outpost: A review of the power generation, energy storage, power management and distribution (pmad) system requirements and potential technologies for development of the lunar outpost," in AIP Conference Proceedings, vol. 813, no. 1. American Institute of Physics, 2006, pp. 1083–1092.