

IAF SPACE POWER SYMPOSIUM (C3)
Space Power System for Ambitious Missions (4)

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POWERING SUSTAINABLE MOON EXPLORATION: ENERGY STRATEGIES FOR
INTEROPERABILITY AND COOPERATION**Abstract**

Energy is a mission critical resource. Developing long-term, large-scale activities on the Moon will require reliable and abundant access to sustainable power supplies. The challenges related to these aspects can be exacerbated by the scarcity of resources such as surface area and sunlight - such as in peaks of eternal light - as well as by the presence of multiple actors with potentially conflicting needs and goals. The aim of the present work is to identify tailored configurations of power generation, distribution and storage solutions with the highest potential to sustainably support the development of strategic lunar locations, such as permanently shadowed regions, far-side smooth terrains and pits. Key drivers in this research are interoperability between different players and compatibility with the peculiar characteristics of the environments under consideration. State of the art technologies are examined and traded off by adopting multi-criteria decision making tools. Criteria are selected among key technical parameters such as energy density and lifespan, and environment-related performances like resistance to extreme temperatures. Each criteria is weighted differently according to the examined strategic location. A sensitivity analysis is conducted to assess how certain technological advancements in power systems can increase their fitness for the reference applications and regions. The outcome is a set of tailored recommendations on power systems selection and technology developments that can mitigate the risk of conflict, inform exploration plans and ultimately contribute to the peaceful development of the Moon. Please note that the present abstract is submitted under the auspices of SGAC's Space Exploration Project Group, as part of the researches conducted within the T.U.R.T.L.E. Research Group.