

20th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND
DEVELOPMENT (D3)

Systems and Infrastructures to Implement Sustainable Space Development and Settlement - Systems (2A)

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GEOLOGIC ENERGY STORAGE AS SHARED ISRU AND ECLSS INFRASTRUCTURE ELEMENT

Abstract

Geologic energy storage has the potential to provide resilience and strategic capabilities to energy grids on Earth and the future planetary human and robotic systems. Terrestrial geologic energy storage can be a viable element of energy transformation, allowing renewable energy baseload. In space, the use of certain geologic formations, like caves, caverns, and lava tubes as materials and energy storage sites can decrease development and launch costs of similar systems otherwise supplied from Earth. Under an ESA-funded project, we are investigating the feasibility of such solutions used in the context of the development of habitats and combined mining and processing infrastructure beyond Earth. Fluids like water, oxygen, and hydrogen produced from local resources, can be injected into formations screened by impermeable layers during the times of energy surplus, and produced during the times of energy shortage, effectively allowing for night survival of multiple infrastructure elements. Large masses of regoliths and rocks may also be used for such purposes. The study outlines, which concepts of technologies can provide this combined materials and energy storage capability, and what requirements should the geologic formations comply with, when we assess their technological potential. This novel Earth-to-space technology transfer is developed in conjunction with a similar feasibility study of geologic energy storage in Poland, and thus adapts terrestrial best practices to a planetary environment.