

SOLAR DYNAMIC SYSTEMS: A PATH TO A LUNAR POWER & LIGHT COMPANY G. P. Barnhard¹ and B. R. Blair², ¹XISP Inc. 8012 MacArthur Blvd., Cabin John, MD, 20818 <barnhard@barnhard.com>, ²NewSpace Analytics, Denver, CO.

Introduction: The ability to provide power when and where needed is essential to virtually all aspects of human endeavor and enables all forms of space development/settlement. XISP-Inc seeks to deliver significant commercial value in the form of power (and ancillary services as applicable) to a growing number of customers interested in Cislunar applications. Solar Dynamic Systems are a form of space solar power technology that promises to be one of the few large-scale energy generation options that can scale to meet the growing electrical energy demand both for space and for terrestrial applications worldwide.

Leveraging NASA Solar Dynamic Technology Investments: The use of Solar Dynamic Systems (SDS) for power generation in space applications holds considerable promise with respect to life cycle cost (in comparison to photovoltaic sources), readiness, availability, and resiliency based on the technology development accomplished to date. As described in numerous NASA design documents and papers, “Solar Dynamic systems consist of a concentrator which collects and focuses solar energy into a heat receiver which has integral thermal energy storage. A Power Conversion Unit (PCU) based on the closed Brayton thermodynamic cycle removes thermal energy from the receiver and converts that energy to electrical energy. Since the closed Brayton cycle is a single phase gas cycle, the conversion hardware (heat exchangers, turbine, compressor, etc.) can be designed for operation in Low Earth Orbit, and tested with confidence in test facilities on Earth before launch into space”. This paper describes a public private partnership approach to leveraging the Solar Dynamic work that was accomplished (then LeRC) both in house and under contract as part of the Space Station Freedom program and to build on it to deliver 25 kW Solar Dynamic System commercial modules that could be applied to a number of Cislunar space applications, including as a power augment to the International Space Station (ISS) as it was originally intended. In addition, the ability to leverage the NASA Glenn work in creating the next generation of technologies for solar power generation and power management and distribution capabilities would be valuable.

Relevance and Alignment: The ability to provide power when and where needed is essential to virtually all aspects of human endeavor and enables all forms of space development/settlement. This partnership seeks to complete the SDS mission design in order to deliver significant commercial value in the form of power and ancillary services to a growing number of Technology Development, Demonstration, and Deployment (TD**3) mission customers interested in operating on

and/or co-orbiting with the ISS as well as to lay the foundation for many Cislunar and lunar surface applications.

The TD**3 missions are intended to also leverage the rapidly evolving U.S. commercial space industry, as well as academia, non-profit organizations, other government agencies/laboratories, other government space agencies, exuberant billionaires, and other motivated individuals with specialized skills/resources in orchestrated efforts to rise to the challenge of creating a vibrant Cislunar development ecosystem benefiting both commercial and government use of space.

Commercial Impact: Having dispatchable and/or deployable space power systems that are modularized and scalable provides an unparalleled level of readiness and resiliency for a range of markets throughout Cislunar space (i.e., from LEO through to the surface of the Moon). The combination of the above as well as reduced piece count, increased durability, lower square footage area per unit of power generated, and robotic assembly/maintainability promise significant economy of scale with respect to power generation and distribution, expanding existing and creating new markets for space electrical utilities.

XISP-Inc was formed in order to create public private partnerships that define and execute TD**3 missions to foster Cislunar space development, which aligns with NASA’s strategic goals for expanding capabilities and opportunities in space. XISP-Inc is seeking to leverage NASA technical expertise, test facilities, hardware, and software to accelerate the development of the TD**3 missions and reduce the costs associated with their implementation and the use of the fielded technologies.

