CONCENTRATED SOLAR DRIVEN IN-SITU RESOURCE UTILIZATION ON THE MOON. A. R. Clendenen[1], B. M. Jones[2], T. M. Orlando[2], and P. G. Loutzenhiser[1]. [1]George W. Woodruff School of Mechanical Engineering and [2]School of Chemistry and Biochemistry, Georgia Institute of Technology.

Introduction: Lunar in-situ resource utilization (ISRU) is of great interest to the lunar exploration community, as it would decrease the weight of materials launched from earth and, therefore, the cost of the launch. ISRU will require power to operate, ideally utilizing preexisting lunar resources. A prime candidate to provide power, is solar which is readily accessible on the lunar surface. To obtain high temperature as is often required for ISRU, it would be ideal to use concentrated solar power. To do this most efficiently, it would be best to choose a location on the moon that maximizes both the solar resources and other resources that would be needed for the desired ISRU process.

Solar Resources on the Moon: The moon is an ideal location for utilizing solar resources. There is almost no atmosphere to reduce the amount of solar radiation, so the solar radiation incident on the lunar surface is ~1365 W/m^2 (compared to Earth's surface ~1000 W/m^2). Since the declination the moon is only ~1.5^o (compared to Earth's ~23.5^o) [1], there is very little seasonal change in the light conditions. In addition, a lunar day is ~14 earth days, and select polar regions on the moon are permanently illuminated. ISRU processes could run for long periods of time without being interrupted during the lunar day, and the lunar night could be used to restock any materials needed for the process.

Comprehensive maps of solar resources on the moon can be created, using the lunar topography information available from the Lunar Reconnaissance Orbiter. Important metrics in assessing solar resources include maps of the average daily direct normal solar irradiance, average daily total solar radiation, and the length of a day at each point on the moon.

Concentrating Technologies: Concentrating the solar resources is necessary to efficiently achieve high temperature. There are three main types of solar concentrating technologies: trough systems, tower systems, and dish systems. Trough systems use single axis sun tracking while tower and dish systems use two axis sun tracking [2]. Each system is capable of concentrating the solar radiation a specific amount, trough systems 30-100 suns, tower systems 500-5000 suns, and dish systems 1000-10000 suns [3]. Likely dish systems would be best for lunar applications, as they require less ground space. In addition, since there is no wind and less gravity, the infrastructure necessary to employ concentrated solar power on the moon could be significantly lighter than it must be on earth.

Other Lunar Resources: In addition to solar resource maps, maps of other resources are also important in determining the ISRU potential of a certain location on the moon. Resources of interest include, mineralogical, water, and hydroxyl. The topography at each location contributes to system accessibility and must also be considered.

Conclusion: Utilizing maps of lunar resources, solar resources, and lunar topography, it is possible to find ideal locations for concentrated solar driven ISRU by maximizing both the resources required by the process and solar potential. An optimized location for ISRU processes is a key step in realizing Lunar ISRU.

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Acknowledgements: This work was carried out as part of REVEALS which was directly supported by the NASA Solar System Exploration Research Virtual Institute cooperative, agreement number NNA17BF68A.