

**An Economic Comparison of Lunar Propellant Production Methods.** G. F. Sowers<sup>1</sup>, [gsowers@mines.edu](mailto:gsowers@mines.edu), Colorado School of Mines, Center for Space Resources.

**Introduction:** Production of propellant on the Moon will be critical for the sustainability of any lunar enterprise. The use of lunar propellant to refuel upper stages can reduce the cost to deliver mass to the lunar surface by a factor of three and lower the cost to return to the Earth or lunar gateway by a factor of seventy. The most efficient rocket propellant in wide use is  $\text{LO}_2/\text{LH}_2$ . Both  $\text{LO}_2$  and  $\text{LH}_2$  can be produced from water ice believed to exist in the permanently shadowed regions (PSRs) near the lunar poles. Alternatively,  $\text{LO}_2$  can be produced from lunar regolith, existing everywhere on the lunar surface.  $\text{LO}_2$  makes up 85% of  $\text{LO}_2/\text{LH}_2$  propellant by mass. Here, I provide an economic comparison of the two approaches. The cost per kilogram to produce  $\text{LO}_2$  from regolith is 16 times greater than to produce  $\text{LO}_2/\text{LH}_2$  from water. When combined with the cost to bring  $\text{LH}_2$  from Earth, the cost per kilogram of the regolith method is 24 times greater. Other considerations include the current uncertainty regarding the nature and extent of water ice in the PSRs, the difficulty in working in PSRs and the potentially useful metallic byproducts obtained from the oxygen methods.