# Lunar Resources

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**I. Introduction and summary of topic from New Views I**

**II. Resources of the Moon: Types, Quantities and Physical Properties**
- A. Materials and energy: two sides of the resource coin
  - o Power is everything (no power = no Moon presence)
  - o All elements are present on Moon, concentrations vary widely
  - o Lunar environment as a resource (e.g., vacuum induction furnace)
- B. Bulk regolith – berms, backfill, landing pads, roads, ceramics
  - o Properties from a resource perspective (grain sizes, cohesiveness, trafficability)
  - o Processing bulk regolith (packing, microwave and solar thermal sintering, ceramic manufacture
- C. Oxygen from regolith – 4/5 of propellant mass in LOX-LH
  - o Ilmenite reduction – feedstock: high-Ti mare, pyroclastics
  - o Magma electrolysis – feedstock: any regolith (high power needed)
  - o Halogen reduction – feedstock: highlands regolith (high power needed)
- D. Metals from regolith – Fe, Al, Ti (residuum from reduction processes)
- E. Materials from Asteroidal and meteoritic origin - Assessment
- F. Water – free water: most useable form, easily harvested, converted and stored
  - o Nature and occurrence of lunar water – monolayer, interstitial, massive ice, hydrated minerals ($M^3$, LCROSS, MRF)
  - o Concentrations and ore deposits – PSRs, partly lit subsurface
- G. Other polar PSR volatiles – methane, ammonia, CO, SO2, simple organics
- H. Quasi-permanent sunlight (QPS) – advantages, thermal environment
  - o Locations, durations, eclipses, tower heights necessary
  - o Storage during eclipse (batteries, rechargeable fuel cells, other?)
- I. Nuclear reactors and their use on the Moon
  - o Fission reactors fueled from Earth
  - o Th reactors and lunar-fueled power; Th deposits on the Moon

**III. Lunar Resource Information Gathering Strategy**
- A. Data in hand vs. data needs – know presence, but not the details. Knowledge gaps
- B. Orbital data – bistatic radar imaging, active neutron sensing
- C. Hard and crash landers – point measurements, ejecta, survivable crash landers
- D. Fixed station landers – point data, long-loved monitoring
- E. Rovers and hoppers – mobile platforms, instruments, transects and profiles
- F. Decision points – how much prospecting data is enough?