Industrial-Scale Lunar Sciences (Seminar: Lunar & Planetary Inst., 29 October 2004, 3:30 pm – 4:40 pm)

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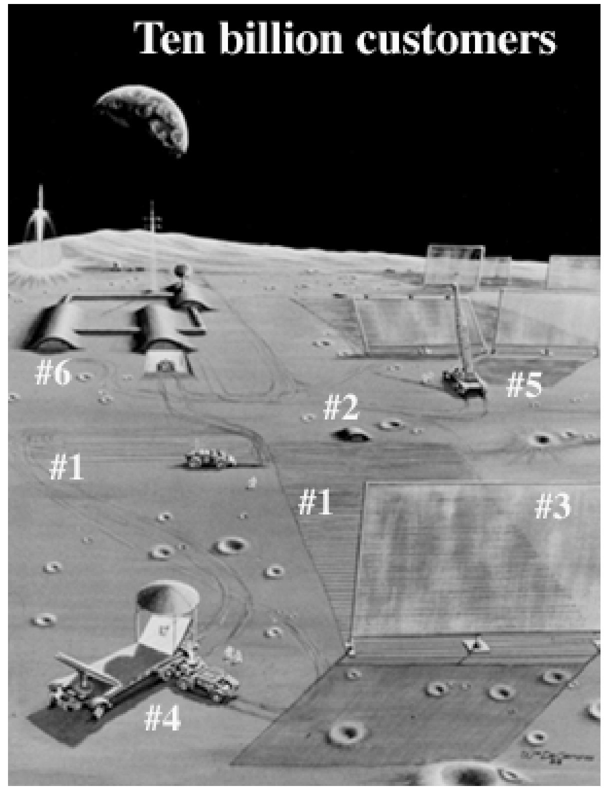
Industrial-scale sciences: 18th century English coal mining and canal construction enabled William Smith to establish the science of geologic mapping and systematic exploration for mineral resources.[1] Global oil exploration and production of declining resources now exceeds 200 B$/y. National needs of the U.S. Civil War, World Wars I and II, and the Cold War established industrial-scale R&D for mass production, telegraphy, aerodynamics, nuclear energy, radio & radar, computing, and astronautics. International Geophysical Years #2 and #3, requiring thousands of scientists and support personnel, were driven partly by the need to understand the interactions of radio, telephone, and power systems with the global and space environments of Earth. Human curiosity drives billions of dollars of private and federal funds into industrial-scale programs such as optical and radio observatories. The United States now expends approximately 2.4% of GNP on R&D. These expenditures are driven primarily by major national needs in health, energy, global electronics, and security and scientific challenges.

Global Prosperity and the Moon: Our global power systems provide the equivalent of ~0.75 kWe/person. Global prosperity requires >2 kWe/person.[2, 3] The Moon dependably receives 13,000 terawatts of solar power.[2, 4] Power stations on the east and west limbs of the Moon can convert a few percent of this dependable solar power into beams of microwaves that dependably deliver more than 20 terawatts to receivers on Earth (>2kWe/person). Each power station consists of tens of thousands of power plots. The figure depicts several prototype power plots. A power plot consists of solar cells (#1), underground wiring (not shown), microwave generators (#2), and microwave reflective screens (#3) that are made primarily from lunar materials and assembled by mobile (#4, #5) and fixed factories (#6) deployed from Earth. More versatile factories (#6) can make significant fractions of the production machinery (#4, #5, #6) from lunar materials.

Lunar R&D: LSP development will enable extensive lunar mapping and sampling programs. Directing 1% of the new electric power to economic development of the Moon can enable, by 2050, a 3 T$/y economy on the Moon and lunar R&D the order of 100 B$/y (~3.3% Gross Lunar Product).



Industrial-scale lunar sciences: Ten years into LSP deployment the power, people, and resources will be available to support active seismology, deep drilling, systematic exploration of the surface, and long-term studies of the interaction of the Moon with the Earth and the solar system. Later on, LSP industries can construct telescopes (radio, optical, UV, etc.) and powerful radars for probing the Earth, other bodies of the solar system, and performing experiments on space plasmas.

References: [1] Winchester, S. (2001 tape) *The Map That Changed the World*, HarperCollins, [2] World Energy Council (2000) *Energy for Tomorrow's World – Acting Now!*, 175pp., see p. 2, Atalink Projects Ltd, London, [3] Criswell, D. R. (2002) Energy Prosperity within the 21st Century and Beyond: Options and the Unique Roles of the Sun and the Moon. Chapter 9: *Innovative Solutions To CO_2 Stabilization*, R. Watts (editor), Cambridge Un. Press, [4] Criswell, D. R. (2001) Lunar Solar Power System: Industrial Research, Development, and Demonstration, Session 1.2.2: 18th World Energy Congress http://www.wec.co.uk/wec-geis/