IAF SPACE POWER SYMPOSIUM (C3)
Solar Power Satellite (1)

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MOONBEAM POWER SCENARIO

Abstract

Moon Bases (or "Moon Villages") need ample power, for example, to move regolith and to produce propellants. Nuclear power may have merit as an alternative, technical, economic, safety, and political issues favor solar power systems.

Preferred locations are near our moon's North and South Poles, on mountains/plateaus that receive solar power nearly continuously during local "summer". Our moon's axis of rotation has a slight tilt with respect to the ecliptic plane, so there are local "summer" and "winter" seasons near the poles. Some polar mountaintops receive continuous sunlight for 6 months of "summer", but little or no sunlight during the "winter". Polar mountains are near permanently shadowed regions which contain resources such as water ice that may be used to produce propellants. [The following scenario also applies at lower latitudes, where the night is approximately two weeks long].

Optimal Moon Base/Village sites are on the Earth-facing side of the moon, for line-of-sight communications and windows with a view of Earth. The Earth-facing side can also receive laser power beamed from Earth. Large concentrating reflectors on the moon can focus diffuse laser beams onto "solar" photovoltaic arrays, to double their power output and reduce the need for energy storage.

Lasers from Earth may also be relayed into permanently shadowed regions, providing power there for "ice mining" and propellant production. Initially, solar arrays may be landed and deployed on lunar polar mountaintops to produce the power that is beamed into these regions. But lasers from Earth avoid the efficiency losses of converting sunlight into electrical power on the moon, and then into laser power.

In the farther future, the system might operate in reverse: When larger scale solar arrays are built on the moon, their power might be sent via laser from the moon to "solar" arrays on Earth. Again, laser light would be supplemental, producing power from photovoltaic cells when sunlight is unavailable (e.g., electrical power demands generally peak after sunset on Earth). In concept, laser light from the moon could be transmitted to Earth using the same mirrors which concentrate diffuse beams from Earth. In the longer term, a large relay mirror might also be placed in a halo orbit around the Earth-Moon L-3 laGrange point, to transmit power to the far side of the Earth, and mirrors at L-4 and L-5 could relay power to the edges of the Earth.