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Author: Dr. Ugur Guven  
UN CSSTEAP, United States, drguven@live.com

UTILIZATION OF NUCLEAR POWER FOR LUNAR OUTPOSTS: NUCLEAR POWER  
GENERATION USING HELIUM COOLED REACTOR FOR MOON HABITATS

**Abstract**

As the closest natural satellite in space, the moon has been one of the main interests of mankind since the dawn of the civilization. Reaching the moon and establishing a base there is very important since it allows moon to become a stepping stone to the rest of the solar system and beyond. However, one of the most important difficulties is establishing a facility with sufficient and independent power systems for sustaining such a lunar outpost. To overcome certain difficulties with power requirements, nuclear power sources will be more advantageous in long term point of view. On the moon, it is essential to have extensive support to create power for the various logistical requirements such as life support, communications, lights, waste removal, etc. as well as for the scientific experiments and for the facilities that will process materials. Thus, functional power sources are needed which can function reliably in long term. Due to its basic properties, chemical or thermal means of generating electricity would be quite difficult under reduced gravity conditions. Moreover, it would create several control and stability issues as well and furthermore they would require excessive amounts of fuel to be either mined or transported from Earth in a continuous manner. However, with the availability of a nuclear reactor, all of the power requirements in a lunar outpost can be met for several years without any difficulty. Nuclear reactor power systems can support human exploration at surface outposts and space stations. A nuclear reactor on the surface of the Moon can be a source of reliable power to provide life support, and to supply the large power demands of facilities processing materials. Unfortunately, the standard types of reactors found on Earth such as the Heavy Water Pressurized Reactor will not be feasible on the moon. Since the moon has the 1/6th gravity of the Earth, the fission kinetics would be harder to control and using water as a coolant will not be practical as having thousands of tons of water on the moon will not be logistically feasible. This can be overcome by using a Helium Cooled Nuclear Reactor where Helium will be used both as a neutron moderator and as a coolant. Since helium is a noble gas, it will not be chemically reactive and also several studies suggest that Helium circulation would function well under reduced gravity conditions and even under microgravity conditions. In addition, the pumping and the cycling of Helium would be easier and the logistics of wastewater will not be a problem as well.