

IAF SPACE POWER SYMPOSIUM (C3)  
Space Power System for Ambitious Missions (4)

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STAGE-WISE ANALYSIS OF POWER PRODUCTION FOR ESTABLISHING PERMANENT HUMAN  
SETTLEMENT ON MARS**Abstract**

One of the major aspects of a permanent Mars human settlement is the development of Self-sustainable, efficient and cost-effective sources of power generation. This research paper classifies various energy resources under certain stages in accordance with the risk involved in extracting them, infrastructure, technology and equipment available with emphasis given to in situ resource utilization. Five stages have been designed in order to assure a self-sustainable Martian colony. Moreover, three key locations on the Red Planet have been selected having safe operational distance from geothermal hotspots and will be able to provide a wind energy back up (due to the proximity of the location to steep slopes) in case of solar power plant failure, dust storms and compensate night time reductions. Initially solar and wind energy has been kept as the main focus followed by nuclear and geothermal resources towards the end of the 5th stage. Conceptual designs such as power beaming and ion harvesting (using electricity inside dust storms) have also been discussed in detail. The calculations for the energy required per habitant have been approximated with those aboard ISS. Therefore a completely power independent colony will begin by deploying buoyant winds turbines ( for low-speed winds) and arrays of solar panels, followed by in situ fabrication of geothermal energy extraction equipment, alongside large VAWT and HAWT turbines will also be constructed. Once all these sources are able to sustain the habitat for a year, nuclear reactors will have to be transported from earth and emphasis will be given to extract nuclear fuel on Mars itself and hence we will have the self-sustaining red planet capable of supporting habitation.