

16th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND  
DEVELOPMENT (D3)Strategies & Architectures as the Framework for Future Building Blocks in Space Exploration and  
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STRATEGIC CONSIDERATIONS FOR RESOURCE UTILISATION IN A FUTURE SPACE-BASED  
ECONOMY**Abstract**

Strategic considerations play a vital part in the development of any economy. Space is becoming cheaper and more accessible partly due to the increased commercialisation of the LEO environment through better transport infrastructure. This is likely to extend further out into the solar-system in the coming decades and will necessitate sustainable resource mining infrastructure in order to accelerate a space-based economy. To be fully effective, resource utilisation requires interactions across many groups of systems independent from the resources, and ultimately the control, of Earth. This paper will discuss the strategic elements of different self-sustaining systems of varying size and complexity, to address the energy considerations of a developing space-based economy. The level of a system's self-sustainability can be measured by the system's capacity to sustain itself without external influence and by the time-frame this self-sustainability can be maintained. On a relatively micro level, biotechnological resource extraction methods such as biomining could help support the requirements for resource utilisation, passive solar radiation for thermoregulation, solar photovoltaics for power, and microbial metabolic heat generation could work together to create a self-sufficient robotic plant. On a macro level a space-based economic model would include aspects of resource extraction, space manufacturing, transportation, trade and construction to ultimately serve the expansion of humanity and development beyond Earth. This paper further seeks to address the gap between in-space energy production and the potential impact of sustainable in-space resource and energy infrastructure on a space-based economy. Finally, a return on investment is considered for an in-space ecosystem enabling productive utilisation of such groups of systems, while addressing potential strategic implications on the wider terrestrial and space economy.