

17th IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE (D4)  
Space Resources: Technologies, Systems, Missions and Policies (5)

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THE FUTURE SPACE RESOURCES UTILIZATION VALUE CHAIN

**Abstract**

In line with the vision of Luxembourg's SpaceResources.lu initiative, the Luxembourg Space Agency commissioned a study to identify the potential markets and value chains for using space resources and the opportunities they will create. In addition to an extensive literature review, data was collected from a large number of interviews with community experts in space agencies, private companies, and universities. This data supported an extensive analysis of the demand side by considering all possible applications of space resources as well as an in-depth look at the supply side and cost-profiles of space resources missions. The analysis assessed the technical aspects and socioeconomic benefits of this promising new industrial sector, and confirmed the enormous opportunities that lie in front of us.

This paper will take a brief look at the elements of the generic space resources utilization value chain and the high-level results of the study including the socio-economic impacts, technology drivers, and the challenges.

By defining a near-term set of space resources utilization value chains it was possible to estimate future resource markets, which in turn informed the development of a strategy to reach towards the visionary goals of the SpaceResources.lu initiative. Although space resources utilization still has some uncertainties requiring planners to make several assumptions, the analysis of the different value chains revealed a number of promising aspects for the future of this important industrial sector. There are opportunities across all stages of the value chains that can be leveraged to create commercial benefits, in particular, early prioritization of specific space resources and uses were identified along with areas for further technology developments. One important result of the study found that the space resources utilization industry itself, is expected to generate a market revenue of 73 to 170 B (Present Value 2018) over the 2018-2045 period, supporting a total of 845,000 to 1.8 million Full Time Employees - Years. The study also identified that space resources utilization can generate sizeable socioeconomic benefits, including economic impacts, employment, market spillovers, and technology spillovers. In addition, there are many synergies expected between the different value chains, for example, those value chains supplying fuel in space will in turn enable value chains providing life support supplies. Lastly, cost savings assessments demonstrated substantial cost reductions for space missions, revealing viable markets for space resources products.