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The Business Case for Mining He-3 From Lunar Regolith

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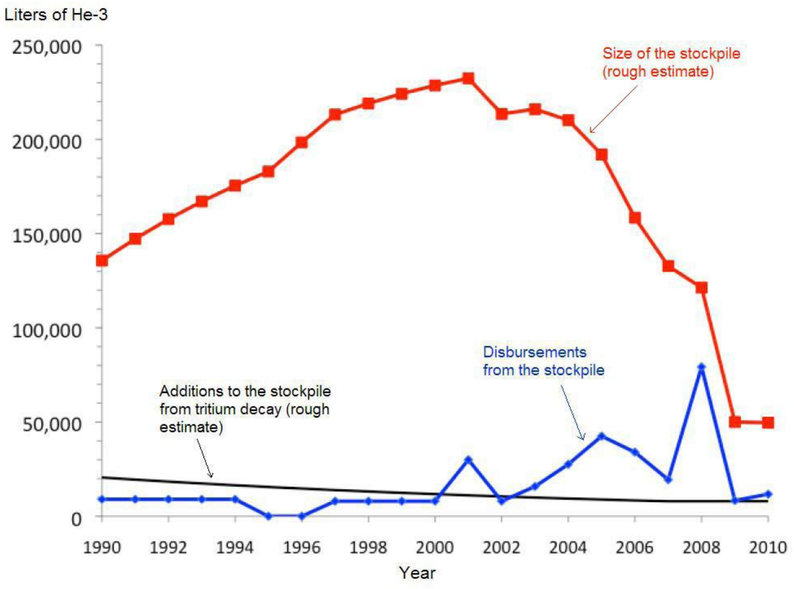
Overview

He-3, a by-product of the nuclear weapons industry, is used in radiation portal monitoring systems for neutron detection. Since September 11, 2001, demand for He-3 for neutron detectors has increased steadily depleting the US stockpile significantly. Due to the impending shortage, there is a high level of interest in identifying methods for obtaining He-3 through other sources or replacing it altogether in neutron detection.

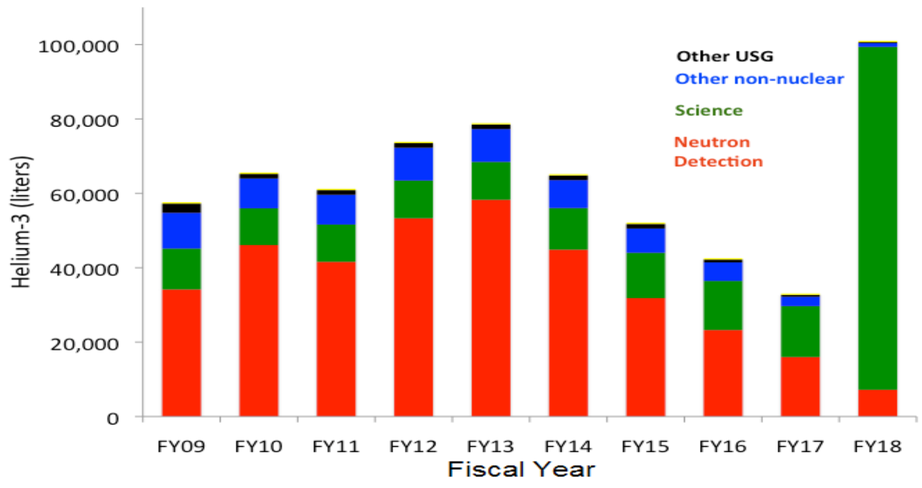


Impact

This research helped understand the source and uses of He-3 and its value in neutron detection – a current issue of national security. A secondary objective was to identify a viable commercial space market. This study determined mining the moon is not financially feasible at this time. However, this research details what is necessary for lunar mining to be cost feasible in the future. By increasing knowledge of the market surrounding the idea of mining lunar He-3, we increase the chances of creating a profitable commercial space market in the future.

Key Findings

1. Identified current and future He-3 Demand



2. Substitutes for He-3 in emerging neutron detectors
3. Alternatives to nuclear weapons as a source of He-3

Current and Potential Sources of He-3 (Liters)								
	2011	2012	2013	2014	2015	2016	2017	2018
Current Tritium Production	8000	8000	8000	8000	8000	8000	8000	8000
Increased Tritium From Light Water	112	223	335	447	559	670	782	894
Import Tritium from Heavy Water (Ontario)	20,000	20,000	20,000	10,000	10,000	10,000	10,000	10,000
Extraction from Natural Gas	3,800	3,800	3,800	3,800	3,800	3,800	3,800	3,800
Total Supply from All Possible Sources	**31912**	**32023**	**32135**	**22247**	**22359**	**22470**	**22582**	**22694**

4. Determined the cost to mine the moon from lunar regolith outweighs the current demand and price of He-3 at this time

TABLE 16: Summary of He-3 Prices		
Year	Price (L)	Detail
Before 2001	<$100	Supply exceeded demand (Shea and Morgan 2010)
2009	$2,000	Commercial Price after discovery of the shortage (Cho 2009)
2011	$600	Price for government use(Kramer 2011)
2011	$1,000	Price for commercial use (Kramer 2011)
2011	$2,400	Prevailing market price for users who do not qualify for allocation from U.S. reserve (Kramer 2011)
2011	$510,108	Calculated theoretical price needed to breakeven under mission assumptions (Data from this study).

Explanation

This research is pertinent to the American Astronautical Society because it seeks to understand the market and opportunities associated with future commercial space endeavors.

Acknowledgements

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