Up and Away: The Market for Helium

Retaining the Government's Strategic Reserve

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"I have this one little saying, when things get too heavy just call me helium, the lightest known gas to man."

—Jimi Hendrix

Most people know helium as the gas that makes balloons float and your voice sound like Donald Duck's. What most do not understand is how crucial this nonrenewable, finite natural resource is to our economy and national security. The 90-year old helium market has, at different times, been dominated by the government as a monopoly supplier, a monopsonist buyer, or a regulator. However, over the past decade, the government has been in the final stages of a long helium privatization effort. This paper will describe how the market for helium functions, and, as a result of this analysis, will recommend that the U.S. Government reverse its decision to sell the nation's strategic helium reserve. Before we begin, let's first examine the characteristics of this crucial and unique gas.

Background

Helium is the second element of the periodic table and is one of the most abundant elements in the universe, yet it is fairly rare on Earth. On Earth, the gas is found in only two places: (1) as a byproduct of natural gas extraction at a few sites around the world, and (2) as a trace element in the atmosphere such that extraction at this time, and probably in the future, is uneconomical, as noted by Z. Cai, et al., of Cambridge University, in their 2007 report, *Modeling Helium Markets*.

Helium's unique properties make it an essential ingredient for electronics, medical devices, industrial application, and cutting-edge research and development. For the U.S. Government, helium is critical in space, defense, and advanced energy systems—there is no substitute if temperatures below minus 429 degrees Fahrenheit are needed. Since 2003, the private sector price for helium has increased by more than 100 percent, according to a U.S. Geological Survey fact sheet. Let's begin by examining the demand for helium.

Demand

While historically the demand has grown about 8 percent yearly, many analysts expect that growth will slow to under 5 percent yearly because of the recent doubling in price. As of 2007, the derived demand for helium was 162 million nanometers (nm) and, according to the paper delivered that year by D. M. Smith, et al., *Challenges to the Worldwide Supply of Helium in the Next Decade*, could be broken out as follows:

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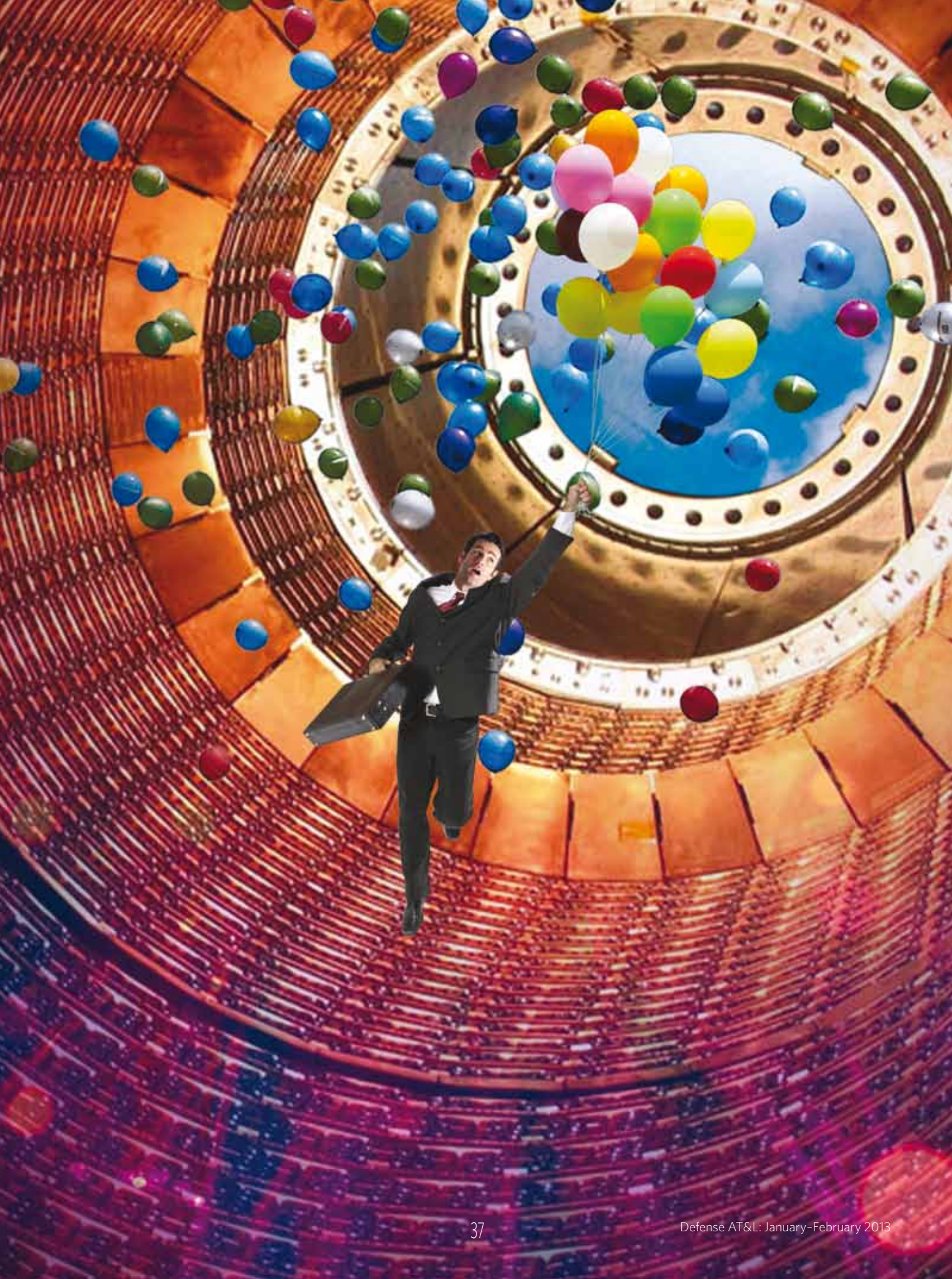

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- Superconductors and MRI (28 percent): MRIs (more than 14,000 machines globally) account for 75 percent of this market segment. This segment is fairly inelastic and is expected to grow based upon increased use of MRIs and future use of superconductors for electricity storage. Higher costs will force equipment manufacturers to make more efficient use of helium.
- Lifting (20 percent): Balloons and blimps comprise this market segment. This is primarily a United States market, and demand is expected to remain constant over time. Hydrogen is a substitute, but it is highly flammable (think Airship Hindenburg).
- Welding (12 percent): Historically, this demand has been only in the United States as foreign markets rely on other gases. Argon is a suitable substitute, but technical changes in many codes and regulations will be required. In the short run, demand is fairly inelastic.
- Instrumentation and Leak Detection (12 percent): The need for higher levels of quality control in manufacturing will drive increased growth in this market segment.
- Fiber Optics (7 percent): This market segment reached its peak in 2001. Since then, demand has dropped by 50 percent but now is relatively constant. Recycling will reduce future growth.
- Semiconductors (5 percent): Helium is crucial in semi-conductor manufacturing; demand will grow.
- Other (20 percent): This market includes space, deep-sea diving, plasma furnaces, and other research-driven applications. This segment probably will drive future demand.

Supply

Helium is a commodity product whose supply on Earth is fixed and finite. The worldwide in-ground reserve is estimated at 39 billion nanometers (nm) located in: Qatar (10 billion); the United States (8.2 billion); Algeria (8 billion); Russia (7 billion); Canada (2 billion); and China (1 billion). Of course, this is just what is believed to be in the ground. What really counts is production capacity and in 2007 capacity was about 173 million nm—according to the paper by Smith, et al., which implies that the industry is working at an extremely high level of 93 percent capacity (demand was cited as 162 million nm). Since helium is a commodity, firms are price-takers. However, in view of a looming production shortfall, prices are expected to continue rising until more capacity becomes available.

Fourteen helium-producing plants operate at 12 locations throughout the world. Two new production plants with a capacity of 17 million nm, one each in Qatar and Algeria, were due on line in 2005 but remain plagued by delays. Within the United States, production sites that have been operating for decades are becoming depleted and bringing on new capacity will be costlier. Today, the domestic private sector production sites meet the entire domestic demand. Constructing new global production capacity will face two challenges: (1) they will cost more to ship to the United States than domestic sites, and (2) they are mostly in the hands of foreign governments, rather than the private sector, thereby creating a very large political risk. In short, global supplies will remain tight well into the next decade and the production capacity will shift from domestic private production to a reliance on foreign governments.

"Once, our defense and aviation industries had a strong need for helium and the nation lacked a market to supply it. A government program was appropriate. But today ... a government-operated program is no longer needed."

—President William Jefferson Clinton, 1996

Role of the U.S. Government

Helium was used by the Army and Navy in aerial balloons during World War I. Believing that helium was crucial to national defense, the Helium Act of 1925 nationalized all existing private industrial production in the United States, making the federal government a monopoly supplier for the next 40 years. In 1960, believing it was time to stimulate private sector involvement, Congress passed the Helium Amendment of 1960 (PL 86-777) that committed the government to buying virtually all excess private sector helium production for 22 years. As expected, the private sector flourished, selling the government all excess helium supplies at a fixed cost.

By 1973, only 13 years into the 22-year program, Smith, et al., noted that the government had an excess stockpile of almost 1 billion nm and canceled the buy-back program. The stockpile however, continues to exist. Since helium is a byproduct of natural gas production, all excess extraction now simply vanishes into the air. In 1996, as part of the government's privatization efforts, the Helium Privatization Act directed the government to sell off the strategic helium stockpile (1 billion nm) beginning in 2005 and completing the sale by 2015.

Private Sector Response

The private sector is responding to the current shortage of helium in several distinct ways. First, helium conservation employs new technologies to conserve helium through products such as leak-proof containers and the capability to capture residual helium during transfer. Remember, helium is an extremely small molecule, so preventing its loss is very difficult. Next, recycling technologies in industries such as fiber optics have proven 95 percent effective in recycling helium within a closed system. Also, research is ongoing to recover helium in applications such as MRI machines after each use, though many challenges remain, as noted by Michael Richey, in *Serv-I-Quip Industry Update: The Helium Market* (2007). Finally, substitutes such as argon or hydrogen are used whenever possible. The next time you think you see balloons floating, check to see if they are really floating or if they are tethered from the ceiling.

Public Policy Recommendation

Helium is a critical input to scientific research, industrial processes, space, and the needs of the Department of Defense. It is therefore in the interest of the U.S. Government to maintain a free and open global market for helium as the most efficient way of ensuring future helium needs. However, there are two important risks that must be addressed: (1) helium exists in a finite amount and if not captured during the natural gas extraction process, it is lost forever; and (2) most of the global helium supply is in nations whose governments control the production process and could disrupt the marketplace as a matter of political or economic warfare.

To mitigate and hedge against these risks, the government should repeal the 1996 Helium Privatization Act requirement that the strategic helium reserve be sold off. The reserve is a critical hedge for the United States against market disruptions. The government also should procure and store excess domestic helium production during periods where supply exceeds demand and the gas is left to vaporize into the air. The government in effect becomes a low-cost helium bank. Taken together, these two actions will provide a robust strategic reserve that both conserves helium from being lost forever and also provides a hedge against market disruption.

Conclusion

The helium market is a fascinating case study in how imperfect markets operate: Helium is a commodity in high demand; it has limited production capacity; and government involvement swings from nationalization to complete privatization. While the idea of eliminating the government's stockpile of helium seemed like a cost-efficient winner more than a decade ago, we can see this is not the case today. With prices rising and supply disruptions possible, the strategic reserve provides the nation with a hedge that, if needed, gives us a buffer for several years, to increase domestic production capacity. For this reason, the U.S. Government should cease the sale of the helium reserve and actually begin plans to increase the strategic reserve by serving as a helium bank for the domestic private sector.

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