VACUUM ENGINEERING

HELIUM SHORTAGE

FACT AND FICTION

"When people talk about the world running out of helium – it's not. It's total fiction."

Phil Kornbluth, Kornbluth Helium Consulting, Global Helium Summit 2.0, New Jersey, September 2016

A global shortage of helium was predicted in 2013, following more than ten years of growth in the global demand for helium with a 5% average annual rate of growth, together with the prospect of resources in the USA becoming simultaneously depleted.[1] This scenario did not materialize; in fact, helium demand stagnated in 2016 compared to 2015. Compared to 2011, consumption even declined by 1.7%.[2]

The helium supply chain is on the brink of a radical upheaval in the near future. Following a shortage of helium resources between the years 2011 and 2013, a phase of overproduction set in between the years 2014 and 2015[3] after the commissioning of the Qatar 2 natural gas field. A balance between supply and demand is forecast for 2016 and 2017.[4] The helium market and so also the news about the raw material helium have long been dominated by the USA.

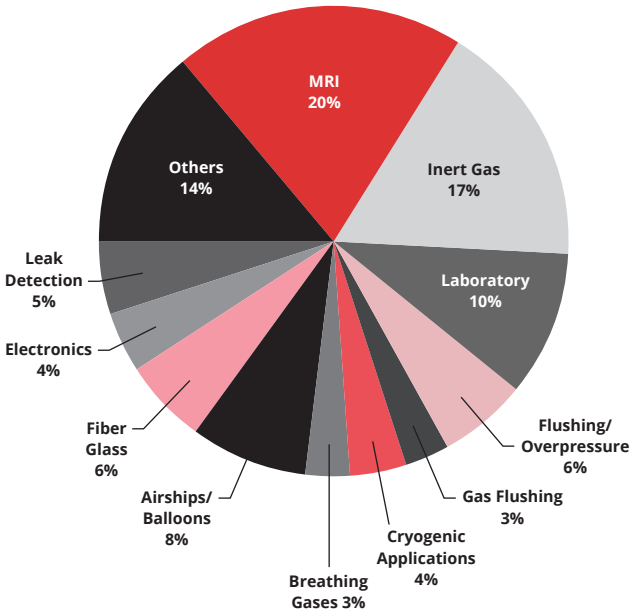
1. http://www.economist.com/news/finance-and-economics/21586840-americas-dominanceglobal-helium-market-ending-inflation-warning (as at 12/28/2016)
2. https://www.gasworld.com/the-2016-worldwide-helium-market/2010924.article (as at 12/28/2016)
3. http://www.helium-one.com/helium/demand-market-fundamentals/ (as at 12/28/2016)
4. Phil Kornbluth, Global Helium Summit 2.0, New Jersey, 12.–13. September 2016

Against this backdrop, key regional agreements to ensure the supply of local markets such as South Africa[5] or Europe[6] often fall between the cracks. This is true for agreements such as the one signed between Praxair, Inc. and Polskie Górnictwo Naftowe i Gazownictwo SA (PGNiG) in June 2016. At its location in Odolanow, the PGNiG has the only helium containing natural gas field in Europe with a global market share of some 1.7%.

As the major global supplier, the USA's share of the overall global output of helium fell from about 2/3 in the year 2013 to about half in 2017. In comparison, Qatar, Algeria and Russia are recording a steep increase in production. Further examples of source countries are Poland, Australia and Canada, which however only contribute a small share towards the global market. The largest global domestic consumer, again the USA, will stop marketing the national Federal Helium Reserve managed by the Bureau of Land Management (BLM) on September 30, 2021. This date was laid down by US Congress in 2013 in what is known as the Helium Stewardship Act (HSA). This does not mean a clean break though, as certain contractually agreed projects will still be handled even after this date.[7] Even after 2021, this reservoir will not be empty, but uncertainty prevails about the future ownership structure and the market behavior of the new owners (ibid.).

In view of this, considerable efforts are being undertaken to develop new sources of helium. This is true for both the classic helium supply from natural gas sources with projects such as Qatar 3 in the year 2018[8], as well as for new channels of helium production, such as from carbon dioxide in Doe Canyon since 2015[9], or extraction of helium from hydrocarbon-free sources. In June 2016, there was a report on the discovery of a helium field in Tanzania that was estimated to cover nine times the annual global demand for helium.[10] The revitalization of well-known helium-containing natural gas sources[11], such as in Saskatchewan since August 2016, contributes to meeting the global demand for helium. In addition, the means of transporting and storing helium become increasingly important in the supply chain.[12, 13]

Global Demand for Helium According to Applications



Moreover, considerable saving potentials are identified. In magnetic resonance imaging, the largest helium consumer with a 15-20% share of global annual production[14], the market leaders are working on magnets with drastically reduced helium use or have already conceived technologies which save 99% of the helium used.[15] Recovery systems for helium used as a flushing gas for rocket engines are an example of the growing tendency to see helium as a valuable raw material. With a 6% share of global annual production, this application is a further major consumer of helium.[16]

In contrast, a single Thanksgiving parade in the USA (Macy's Thanksgiving Day Parade, New York) uses 8,500 cubic meters of helium worth 30,000 USD alone just for filling big balloons.[17] A total of 8% of global annual production of helium is used for balloons and airships.[18]

The virtual withdrawal from the market by the Federal Helium Reserve expected to take place in 2021 will result first and foremost in a loss of flexibility in supplying the domestic market of the world's major consumer nation.[19]

5. https://www.gasworld.com/contract-for-exploitation-of-south-africas-only-he-field/2010395.article (as at 12/28/2016)
6. https://www.gasworld.com/praxair-reinforces-he-supply-in-central-europe/2010712.article (as at 12/28/2016)
7. Samuel R. M. Burton, Gasworld, Januar 2017, S. 34f
8. https://www.gasworld.com/exclusive-helium-update-at-gawda-atlantic-city-regional-meeting/2010438.article (as at 12/28/2016)
9. https://www.gasworld.com/air-products-hits-100th-helium-milestone/2010106.article (as at 12/28/2016)
10. http://www.helium-one.com/projects/rukwa/ (as at 12/28/2016)
11. https://www.gasworld.com/operations-commence-at-saskatchewan-he-site/2010829.article (as at 12/28/2016)
12. Carlos Nulman, Gasworld, Januar 2017, S. 31ff
13. https://www.gasworld.com/world-first-air-liquide-commissions-he-storage-site /2010766.article (as at 12/28/2016)
14. http://www.helium-one.com/helium/uses-of-helium/ (as at 12/28/2016)
15. General Electric Press Release: Setting Helium Free: Revolutionary MRI Tech from GE Healthcare, Chicago, 29. November 2016
16. https://www.gasworld.com/si-delivers-he-recovery-system-to-nasa/2010618.article (as at 12/28/2016)
17. http://www.livescience.com/10300-helium-needed-fill-macy-parade-balloons.html (as at 12/28/2016)
18. http://www.helium-one.com/helium/uses-of-helium/ (as at 12/28/2016)
19. Phil Kornbluth, Kornbluth Helium Consulting, Global Helium Summit 2.0, New Jersey, 12.–13. September 2016

The amount of helium marketed by this domestic US resource dropped by 50% between 2013 and 2015.[20] The gas output in 2016 however still equated to some 22% of the global annual demand.[21] This share will gradually be scaled back to less than 10% by the year 2020. In 2015, the site was shut down for 102 days, due in part to a lack of demand.[22] Although domestic demand in the USA rose again significantly in the year 2016,[23] a steady supply of helium is forecast worldwide for the coming years.[24] Exploitation of the recently discovered Tanzanian field will start in the third quarter of 2017, and considerable amounts of helium will come onto the market from Russia in the years 2021 to 2024.[25]

A further key aspect of helium supply is the extreme volatility of its price. There are certain publications that speak of increases of 476% in the price of grade A helium gas (with a purity of 99.995%) in the USA over the last 15 years.[26]

This trend has leveled out most recently. After Qatar 2 was put in operation in 2013, the price of helium in the industry even dropped about 20%. It remains difficult to forecast how prices will develop in future. This depends largely on economic decisions by the six multinational corporations who hold all the helium sources in the world in their hands,[27] and also on general raw material speculation. It also remains to see whether low-priced gas purities (such as 2.8; 99.8%) between helium balloon gas and helium 4.6 (99.996%) as often used for leak detection, are likely to be on offer again in future.

Summing up, it can be said that as far as helium leak detection is concerned, which accounts for a mere 5% of global annual demand for helium[28] (and which, by the way, has used recovery systems for decades), supply shortages are not to be expected in the future. The horror scenario of helium resources being exhausted within the next 25 years[29] does not stand up to closer scrutiny in the light of other data sources. Assuming constant annual consumption of some 170 million cubic meters[30] at the current level, the quantity of 51.9 billion cubic meters[31] on tap from known reserves throughout the world, would last for 305 years in purely arithmetical terms. Even adopting a pessimistic outlook, detailed forecasts assume that helium from natural gas sources will be on hand for at least 130 years.[32]

Any extra helium supply which becomes available through developing new resources, or through savings, recovery and other production technologies will not be short of uses in the future in airship travel, balloon-supported internet provision, and helium-filled hard disk drives.[33]

Ultimately, demand and price will be responsible for regulating the supply of helium. Although isolating helium from natural gas mixtures is currently only economical when a minimum content of 0.2% is involved,[34] it is conceivable that the demand for helium may even result in it being extracted from the air (in a concentration of 0.00052%) or this becoming enriched with it. Potential technologies include the already implemented extraction of helium from helium-neon mixtures[35] during liquefaction of the air or the enrichment of helium through pressure swing adsorption (PSA),[36] as in the Canadian project mentioned above.

20. https://minerals.usgs.gov/minerals/pubs/commodity/helium/mcs-2015-heliu.pdf (as at 12/28/2016)
21. Samuel R. M. Burton, Gasworld, Januar 2017, S. 34f
22. Robert Jolley, Bureau of Land Management (BLM), Global Helium Summit 2.0, New Jersey, 12.–13. September 2016
23. http://www.heliumscarcity.com/?p=2626 (as at 12/28/2016)
24. Joe Horn, Linde AG, Global Helium Summit 2.0, New Jersey, 12.–13. September 2016
25. https://www.gasworld.com/russia-helium-surge-continues-as-linde-contracted-by-gazprom/2009834.article (as at 12/28/2016)
26. https://minerals.usgs.gov/minerals/pubs/commodity/helium/ (as at 12/28/2016)
27. http://www2.mathesongas.com/BulkGases/GlobalHelium.aspx (as at 12/28/2016)
28. http://www.helium-one.com/helium/uses-of-helium/ (as at 12/28/2016)
29. http://www.peakscientific.com/articles/availability-of-helium/ (as at 12/28/2016)
30. http://www.helium-one.com/helium/demand-market-fundamentals/ (as at 12/28/2016)
31. https://minerals.usgs.gov/minerals/pubs/commodity/helium/mcs-2015-heliu.pdf (as at 12/28/2016)
32. Steve Mohr, James Ward; Helium Production and Possible Projection; Minerals 2014, 4(1), 130–144
33. http://www.helium-one.com/helium/uses-of-helium/ (as at 12/28/2016)
34. http://www.the-linde-group.com/internet.global.thelindegroup.global/de/images/linde_annual_2009_d16_10256.pdf?v=. (as at 12/28/2016)
35. http://www.periodensystem-online.de/index.php?el=2 (as at 12/28/2016)
36. http://www.engineering.linde.co.th/th/news_and_media/press_releases/news_20160803.html (as at 12/28/2016)

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