Ever Changing Rare Gas Market

by Richard Betzendahl

In "Still Bullish on Rare Gases" (*CryoGas*, February 2012, p. 28), I discussed the production of rare gases including market share by company. In this article, I focus on supply and demand of krypton (Kr), xenon (Xe), and neon (Ne), including key applications and their effect on price development in the past and into the future.

Data Review

Last year, I estimated total 2012 world production of Kr would be 97 million liters, production of Xe at 10.5 million liters, and Ne production at about 625 million liters. In my follow up plant-by-plant analysis, I found that the 2012 world production totals changed with the direction of global steel production and the addition of new air separation units (ASUs) with rare gases production. Of the approximate 100 ASUs with crude Kr and Xe production operating in 2012, I confirmed production of Kr at 97 million liters annually. The Xe estimate for 2011, however, was a little high, with Xe production currently about 9.8 million liters. The Ne production estimate was a bit high as well. After reviewing the approximately 20 worldwide ASUs that produce Ne, I found my original estimate to be about 10 percent higher than the approximately 550 million liters actually produced in 2012 based on my new research. This difference was due to some ASUs with Ne production not operating their crude columns.

I predicted krypton would become tight in 2012—and it did early on—but demand fizzled out by 4Q12. Demand for krypton in insulated window manufacturing, a major application for this gas, recovered well from the 2009 recession but fell off as Europe went back into recession in 2012, slowing construction and related sales for windows, and causing a decline in Kr demand. The largest application for Kr—lighting—also flattened due to the changes in the energy efficiency regulations for light bulbs implemented in Europe, the US, and Australia. New energy efficient lighting, such as compact fluorescent bulbs and LED, do not require krypton. In addition, the new fluorescent tubes, some of which use Kr, now are half the diameter of the older tubes and use less gas.

Demand and pricing for xenon and neon was predicted to be flat in 2012 and this turned out to be accurate, with no change seen. I also predicted for 2013 and beyond that there would be increases in Xe demand and pricing, and early indicators show this happening. This increase has been caused largely by the launch of Xe halogen light bulbs, which compete with compact fluorescent bulbs and LEDs. Halogen bulbs, which use xenon, meet current government energy efficiency requirements while offering better lighting features than the compact fluorescent and are much less expensive than LED.

Rare Gas Supply and Demand

Krypton

In the early 2000s, krypton was in an overproduction situation due to the increase in new ASUs with crude Kr and Xe production built mostly in late 1990s. (*See Figure 1.*) With prices very low, any new production added was a big loser from a return on capital perspective.

During the global economic growth years of 2004 through 2008, Kr demand absorbed the excess supply. Demand was driven mostly by the window insulation market in Europe, increased demand for lighting from new construction particularly in developing countries, and rising demand for inexpensive lighting. This demand drove Kr prices up significantly, but the global recession that began in 2009 changed everything. As shown in Figure 1, both demand and production of Kr declined at this time. Reduced Kr production was a result of declining oxygen production as demand for oxygen in the global steel industry fell. With the decline in demand far greater than the decline in production, prices fell rapidly.

During 2012 the supply and demand of Kr became more balanced, but as mentioned, faltering demand for Kr in the window insulation application in Europe slowed overall demand at the end of the year. With the flattening demand for Kr in European window market and slowing global demand for Kr in lighting, we are beginning to see some inventory building. By mid- to late-2013, expect to see an over-supply situation. This will cause prices to erode as producers try to move their inventory. On a positive note, the window insulation market in the US could expand in 2014 and beyond as prices decline slowly and the oversupply is absorbed. In the past, when Kr prices to end users in the US window market were in the $0.50 to $0.70 per liter range, this application grew. This could be an opportunity for local gas suppliers.

Supply and Demand of Krypton

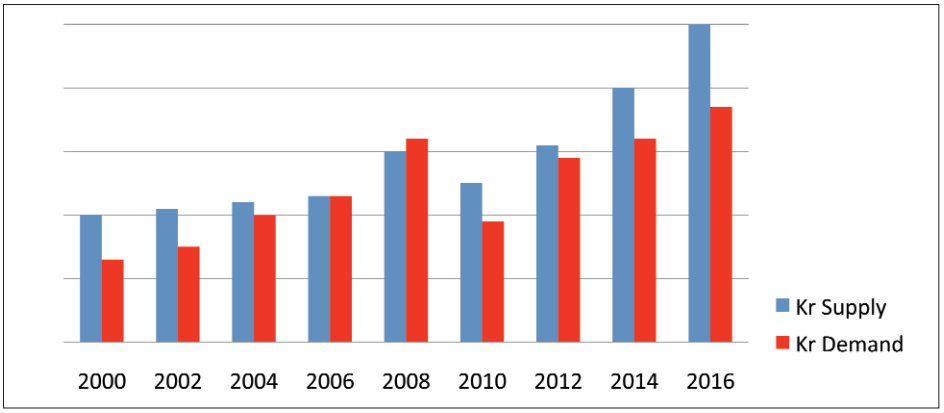

Figure 1

Source: Betzendahl Consulting Group

Xenon

Xenon supply and demand has been even more volatile than Kr in the past and will continue to remain volatile in the future. (*See Figure 2.*) Similar to Kr, Xe was in over production but enjoyed only moderate growth in demand in the early 2000s. Prices stayed low as producers tried to sell inventory.

From 2005 to 2008 demand for Xe grew rapidly as Plasma Display Panel TVs (PDP), which use Xe and Ne in the plasma between sheets of glass, became popular. At the same time, Toshiba and a few other electronic chip manufactures began to use Xe as an atmosphere in a new etching process. These two new applications added about five million liters of Xe demand on a global production of about 10 million liters. This pushed the demand to about 30 percent above production and prices increased 8–10 fold. Both markets collapsed with the 2009 recession, PDPs were out-marketed by LCD TVs, and Toshiba changed their etching process due to costs. Xe lost about four million liters of demand and the price collapsed accordingly, more than five-fold.

Xenon remained in over production until late 2012 when the lighting industry increased its Xe demand, by about 1.0 million to 1.5 million or so liters. This increased use of Xe was for halogen bulbs, due to government efficiency regulations as described previously. This, together with the sporadic increased demand for Xe in satellites, has begun to tighten supply, which will trigger increases in Xe pricing. For 2013 and beyond, this situation will continue.

Also, the expanding application of Xe in anesthesia could additionly tighten the market by 2015. Air Liquide is in the process of gaining approval for use of Xe in an anesthesia gas delivery device for high risk patients in the EU. Currently the global Xe used for this application is only a few hundred thousand liters. With this application gaining approval in 2015-2016, it could use a few million liters of xenon and put a lot of pressure on the Xe supply. (Note: Air Liquide is already moving Xe into inventory to have the necessary product to launch this application after EU approval.)

On the other hand, Xe use in lighting will decline by 2015 or 2016 as LED lighting becomes less costly and is adopted by the consuming public. Since lighting is xenon's largest demand driver currently, this decline could minimize the under supply and cost increases caused by the launch of anesthesia application in the EU.

Supply and Demand of Xenon

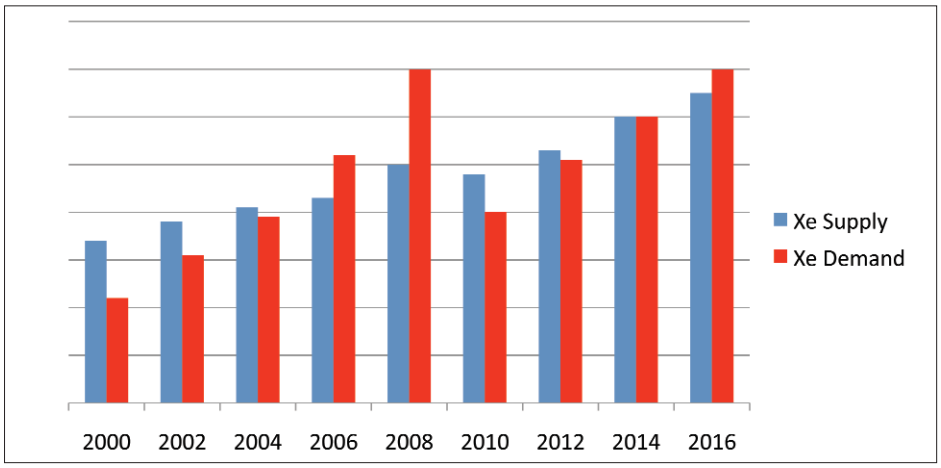

Figure 2 Source: Betzendahl Consulting Group

Supply and Demand of Neon

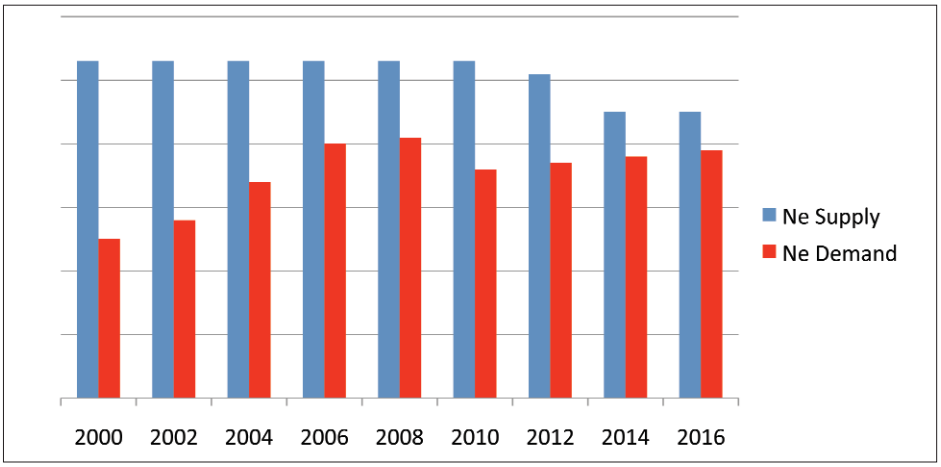

Figure 3 Source: Betzendahl Consulting Group

Neon

As a commodity, neon is different from Kr and Xe as it is produced on a separate neon extraction column and is found in greater abundance in our atmosphere than other rare gases. Currently, most Ne is produced in eastern Russia as the former Soviet Union viewed neon as a strategic military product for laser weaponry development from the 1980s. Due to this significant production capability in Russia, global demand for neon has never reached the supply limit. (*See Figure 3.*)

Demand for neon has been rising since the 1990s, driven by expanding applications for Ne in lasers, including in cutting, medical, and etching processes. The early 2000s saw continued expansion for neon use in laser markets and new growth in Plasma TVs. This growth caused an increase in Ne prices, which almost doubled from 2000–2008. Demand for neon fell in 2009, but modestly, due primarily to the decline in the PDP application described previously, and neon prices have been relatively stable.

I expect to see the neon market continue to expand over the next few years as laser applications grow and developing countries require more lasers gases for all applications. By 2016, we could face a supply problem. Limited new production has been added in the last 20 years, and many of the old Eastern Europe plants are being replaced with new ASUs, which may not have Ne production. Some new neon production has been added in China but for domestic use only. If new production is not added by 2016-2018, I expect worldwide demand for neon to outstrip supply and prices to rise quickly.

Rare Gas Price Volatility

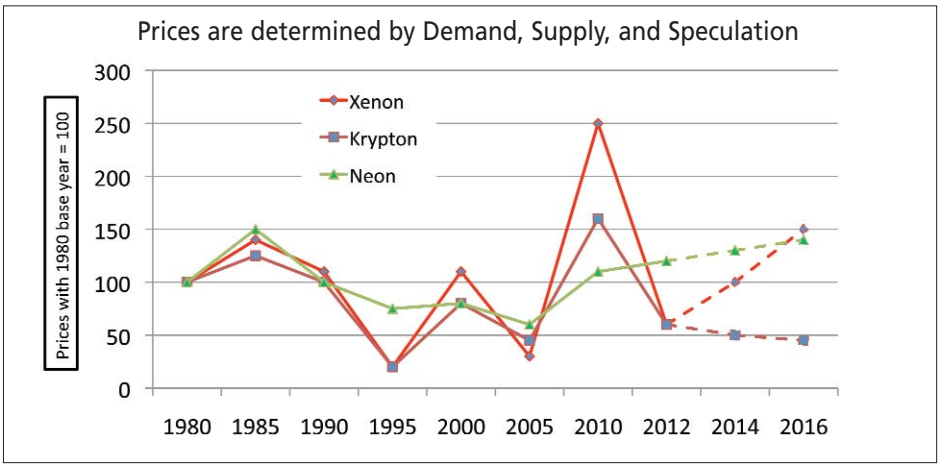

Figure 4 Source: Betzendahl Consulting Group

Keeping It Interesting

In conclusion, expect Kr demand and pricing to decline slowly over the next year or two but firm up as the lower-priced product is absorbed by window insulation growth in the US and elsewhere. Xenon demand will grow by 10 percent or more in 2013 and 2014, but then they will flatten out as LEDs take hold and reduce the demand for lighting applications that use rare gases. If xenon is approved for use in anesthesia in the EU and the application is embraced by the medical community, expect Xe prices to rise rapidly in 2015-2016. (*See Figure 4.*) The market for neon will continue to expand driven by laser applications, particularly in developing nations and in electronic chip manufacturing. This growth in demand combined with a decline in supply could cause problems as early as 2016 if no new production is added.

The rare gases market is very volatile and also very interesting. I am bullish on the future of krypton, xenon, and neon. For more detailed information, please feel free to contact me. ■

FELIX DUAL is the technological innovation that gives access to anesthesia with xenon while classical anesthesia with nitrous oxide and/or anesthetic agents remains available. Photo courtesy of Air Liquide

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