

# Rare Gases Market Update

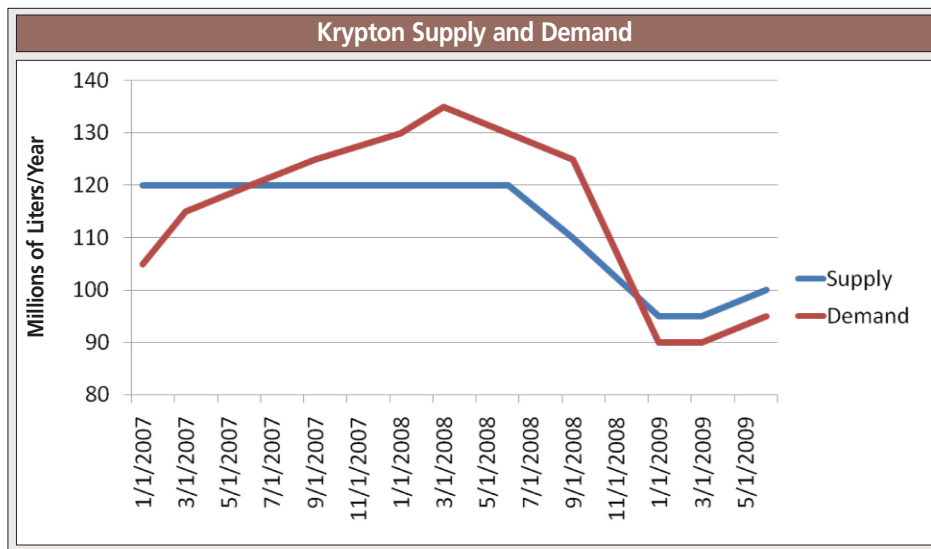
## Demand Is Down but Unique Applications Give This Market Staying Power

By Richard Betzendahl

As the economy slows down so does the demand for rare gases. During the last 12 months demand for xenon (Xe) declined almost 40 percent and demand for krypton (Kr) fell by about 30 percent. As I reported last year (*"The Rare Gets More Rare," CryoGas International, July 2008, p. 26*), krypton and xenon prices had increased almost tenfold over the previous 12–18 months. During that period, Kr prices went from an average of \$0.30 to \$1.90 per liter, and Xe from \$3.00 to \$28.00 per liter.

Demand and prices for these commodities peaked in the late summer of 2008, and downward trends for Kr and Xe began in late fall 2008, as the world's economy began to stall. The industries that had the largest impact on the demand decline were the manufacturers of plasma panel TVs, electronic chip manufacturing, lighting, and insulated window manufacturing. While demand fell quickly, prices for krypton and xenon did not begin to fall immediately as the supply of both products was curtailed by the slowdown in oxygen production at the large ASUs around the world, which are equipped with Kr/Xe columns. Approximately 135 million liters of total world production of the mix of crude Kr and Xe declined with the collapse of the world steel demand. Seventy percent of the world's production of the crude rare mix is a byproduct of the large oxygen plants at steel mills. The steel industry in Russia and the Ukraine was off 40–50 percent and the Western steel industry was down about 30 percent. Due to the steel industry decline, worldwide production of the crude mix of Kr/Xe was down to about 100 million liters/year by the end of 2008. This decline of production was paralleled by a decline in usage during the same period. By January of 2009 demand for Kr/Xe had declined more than production, causing price declines to accelerate.

A portion of the shortage experienced in 2008 of these rare gases was due to customers hoarding product, which exacerbated the



decline in demand. Before that, end-users were buying more product than they needed as a way to lock in prices before they started to climb again and to insure they had product for their own production. Over the past twenty years, rare gas customers have seen wild cyclical price gyrations. When rare gas end users saw their purchase requirements decline in late 2008 and early 2009, they stopped buying at high prices and turned to their inventory. At this time, rare gas producers could not stop producing, or had to vent the crude mixture to atmosphere. Most continued to produce while selling at lower prices to try to move their production.

### KRYPTON

The increased demand for krypton in 2007 and 2008 was driven by the insulated window industry and the lighting industry. The window industry, which uses 40 percent-plus of the world's supply of Kr, or about 45 million liters, was responding to a building boom and rising demand for "greener" structures that require krypton insulated windows. The insulating value of Kr is about twice that of argon, which has about twice the insulating value of air. With the rapid rise in oil prices during this

period, Kr-filled windows became very popular, particularly in Europe where some countries already had regulations for minimum insulating values in windows. When the building boom ended and oil prices dropped, the demand for these windows fell dramatically. I estimate this business is now off by as much as 30–50 percent with some customers still using inventory from last year.

The lighting industry has been growing in the developed world at about four percent annually. In emerging countries, growth in the lighting sector was much higher, at 10–20 percent annually. With the current world recession and decline in commercial and residential construction, lighting demand has declined and with it demand for krypton. The Kr lighting business is down as much as 20 percent worldwide, to about 45 million liters or less, from a high of 55 million liters in 2008.

We are now beginning to see demand for Kr return, albeit slowly. Prices for Kr (10,000 liters or greater) peaked at \$1.75 to \$2.50 in Q4'09. In the last five months prices have fallen to about \$1.15 to \$1.75. I expect the prices to continue to decline, but more slowly, with prices stabilizing when the world economy does.

## XENON

Xenon demand peaked in the spring of '08, stabilized that summer, and began to decline late in the fall. The key industries that use xenon (largest application to smallest) are lighting, flat panel plasma displays, electronic chip manufacturing, ion engines for satellites, lasers, and anesthesia. In this recession, xenon demand has declined more sharply than demand for krypton.

As we all know, the last 12 months have been devastating for the auto industry, with business off by some 35–45 percent. The lighting industry uses xenon in many types of specialized fixtures with the largest application being headlights for automobiles. The xenon headlight manufacturing business unfortunately has followed the same downward trend as overall automotive production.

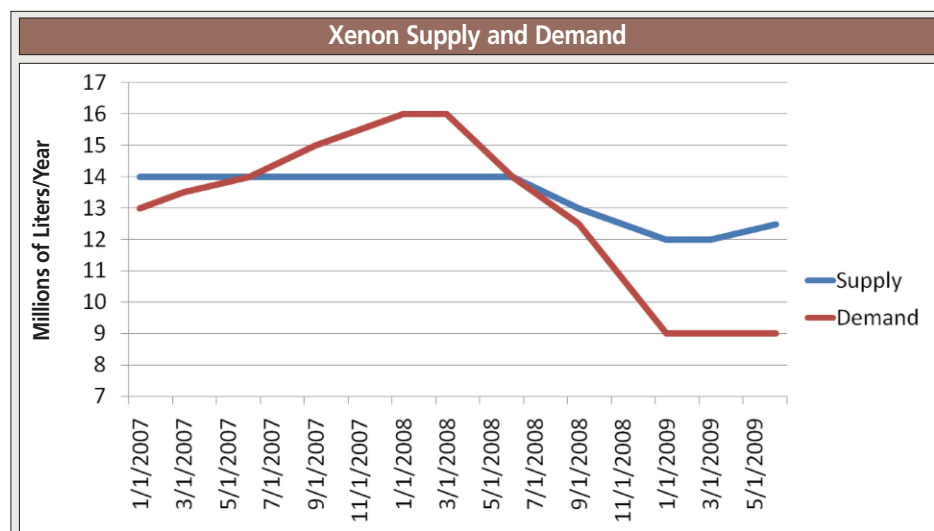
Plasma panel production (PDP) is also down with consumers not buying TVs as vigorously as before, with some PDP manufacturers shutting down production completely.

Demand for Xe in electronic chip manufacturing has been significantly reduced. Two separate forces are at work here. Last year's high prices for Xe caused chip manufacturers to implement conservation measures (*see "Recovering Xenon — and Costs," on p. 38 of this issue.*) These measures have effectively reduced demand for Xe. In tandem with declines in Xe demand due to cost containment, there has been an overall reduction in demand for chips as the world economy turned downward. Today, demand for Xe in the semiconductor industry is down more than 50 to 70 percent.

The use of Xe in space satellites has also declined as both the industry and governments tighten budgets in a faltering economy. Some projects have been put on hold and others canceled, causing overall demand for Xe in this sector to fall significantly. The Russian government, one of the largest consumers of Xe for this application, has postponed their program for 2009 and has not purchased any Xe.

Lasers are used in many market sectors including the medical sector, which is resilient in economic downturns. Laser applications that use Xe have been less affected in this recession than PDP applications.

Xenon used in anesthesia is a new and developing application. Here there are still signs of growth with medical industries more recession-proof than most. Unfortunately, the amount of xenon used in this application does



not have a significant impact on demand. Xenon in anesthesia is also a very costly application and requires expensive xenon recycle equipment to make it feasible.

Prices for xenon began to fall in Q4'08 and continued falling in 2009. Forty percent of the world's supply of xenon is sourced from crude rare mixes produced from non-steel operations, such as Sasol's coal gasification facility in South Africa. The supply of xenon, therefore, has not been as affected by declines in steel making O<sub>2</sub> as krypton production has.

### RARE GASES OUTLOOK

I expect krypton supply and demand to stabilize within the next few months. Kr prices should not decline much further, possibly by another 10–20 percent. I expect demand for xenon to continue to decline, creating increased inventory at all producers, and causing further price declines for that product. Xenon could drop another 20–50 percent from today's pricing. My estimates are based on the world economy bottoming out this summer and beginning to improve by late 2009 or early 2010.

While it is very hard to accurately predict the balance of supply and demand for 2010 and beyond, I note that all the major industrial gases companies are adding some rare gas capacity. Current full capacity of Kr is almost 120 million liters and Xe is almost 14 million liters. It is estimated that planned additional capacity over the next two to three years will add more than 20 million liters of the crude mix to the total, with about 18 million liters of Kr and two million liters of Xe. It is reported that Linde is adding about half of all this new capacity. If demand does not come back quickly, this new production

could force prices even lower for a number of years to come.

Remember, it was only in 2007 when Kr sold for \$0.30 to \$0.50 per liter and Xe sold for \$3.50 to \$5.00 per liter. We could be headed toward those pricing levels again, although I think that unlikely as there are many opportunities for Xe and Kr demand to grow rapidly in 2010. When the world economy begins to grow again, oil prices will rise, and the green movement, particularly in the US, could easily consume this additional volume. The use of krypton for insulating windows, both replacement and new construction, could create significant new demand for krypton. Xenon has opportunities as well. Delayed satellite programs will return with a stronger economy and push xenon demand. Xenon-filled lights are an energy saving solution and this should also drive Xe demand in many countries, including the US. All western countries have, or will have, minimum standards for energy usage in lighting. Lastly, demand for xenon in the PDP and the electronics industry will also return as those markets reemerge from the recession. PDPs are moving to a higher Xe percent in their panels and the electronic application for Xe was just starting to be adopted before the industry slowed. Krypton and xenon are rare and their usages unique, giving this market good prospects for growth in the long term.

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