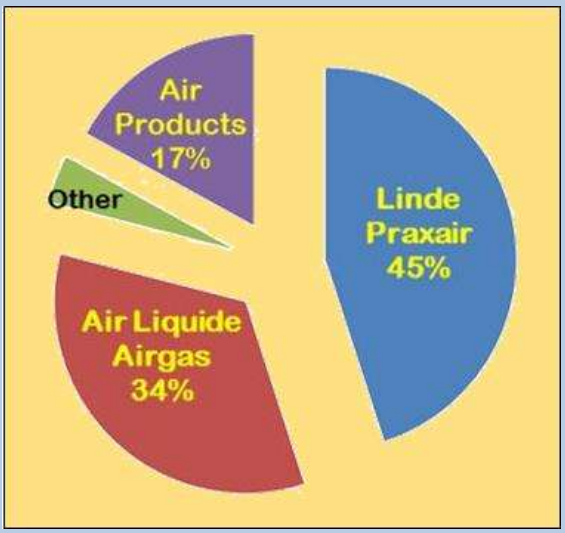
Prices for Argon and Helium More than Doubled Recently!
Why Do Argon and Helium Shielding Gases Cost So Much?
What Can Be Done About It?

by Jerry Uttrachi

ALERT- 2017 Brings Major Changes!

Merger of 4 industrial gas producers in 2017 has two companies with ~79% of the American Argon Capacity! If you thought doubling of Argon and Argon/CO_2 Shielding gas prices recently was excessive- - HOLD ON TO YOUR WALLET!



Using the data presented in a US Argon Market Report (reference 3) the Argon production capacity graph left was produced! It shows the German company Linde AG who purchased my old company, Praxair (*who divested of their welding and cutting businesses in 1985 and changed their name*) and Air Liquide a French company, who bought Airgas last year, now have a combined Argon production capacity of 79% in America! It is probably ~75% today- Scary.

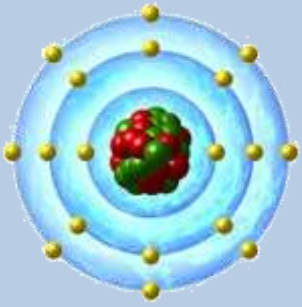
My personal experience with European industrial gas companies indicates they don't care about the welding hardgoods or welding filler metals businesses! (*In fact Air Liquide sold their welding hardgoods businesses when they bought Airgas!*) In Europe they sell gases, their sales people are trained on selling gases and the senior management far prefers a business that has: 1) no raw material cost, 2) has no inventory except cylinders (*which in Europe they only rent*,) 3) has no obsolescence/spoilage/theft of product, 4) has prohibitive barriers to entry (*very high cost for a competitor to enter or expand*), 5) can't be imported from China-etc.!

When I managed a Market Development effort for what was the largest Argon producer at the time, our stated goal was keeping Argon demand larger than supply! We also owned many distributors. 100+% of our owned distributor profits came exclusively from selling gases and selling filled cylinders to other small independent distributors! When they divested the hardgoods businesses to focus on the industrial gas business, I became VP of the welding, cutting and filler metals business that formed!

From their own market research, the gas producers know well over 50% of the shielding gas bought is wasted! Our WA Technology business is focused on reducing that waste with our low cost patented products and knowledge!

The following provides some perspective on the cost issues related to Argon and Helium shielding gas and mixtures that include these gases. It also presents an inexpensive solution to cut gas costs. References to articles where some of this information was obtained are sited and provided at the end of the report.

ARGON



Argon is the third most abundant gas in air, after Nitrogen and Oxygen. Although Argon is less than 1%, (0.93%) that is 24 times the next most abundant gas, Carbon Dioxide at only 0.039%. This small amount gets all the press! Argon is produced by liquefying air and then distilling the Argon out in a large column. Several steps are required to achieve welding grade purity. AWS A5.32, "Specification for Welding Shielding Gases" defines 99.997% required purity and a maximum moisture of 10.5 parts per million (ppm) for liquid and gaseous Argon. A first stage distillation column produces what is called "Crude Argon" containing 1 to 2.5% Oxygen and 1 to 2% Nitrogen. The "Crude Argon" can be reacted with Hydrogen to eliminate the Oxygen. Another "Pure Argon" distillation tower is then used to remove the remaining Nitrogen and Hydrogen. This process and the extra capital equipment needed to produce Argon are very expensive. Many gas liquefaction plants built over the years did not include this extra capital cost.

Of interest, some companies have tried to market, "Crude Argon" for welding. The small amount of Oxygen present is typically not a problem when welding steel. However, the Nitrogen can be a significant problem. Reference 1 defines that 2% Nitrogen in the shielding gas is sufficient to produce internal porosity in single pass welds and as low as 0.5% produces porosity in multipass welds. Ludwig, (reference 2) used a bubble chamber and mixtures of shielding gas with various amounts of Nitrogen. He concludes, for his single pass welds, that shielding gas should not contain more than 1% and preferable 0.5% maximum Nitrogen.

Production Capacity: An article entitled US Argon Market Report (reference 3) defined percentages of Argon capacity in 2010 by company. The chart at right shows that four companies dominate the market. Argon is a byproduct of Oxygen and Nitrogen production; companies must manufacture and market those gases to make Argon production economical. When very large volumes of Oxygen were being consumed by the steel industry, Praxair installed large gas production facilities at these mills. The large gas liquefaction plants were equipped with the added capital investment to produce Argon. As the American steel industry reduced in capacity, the amount of oxygen needed did not require operating these plants at high capacity. However, the demand for Argon was high and growing (as it is today.) To satisfy customer demand, the plants were

occasionally operated to produce this 0.93% content product, Argon! Production is not economical in this situation. Even at high Argon prices, the electric power and capital equipment investment required to liquefy air, to sell only 0.93% while venting 99% is not justifiable.

The same situation exists in the current economy; Argon demand growth is reported to be 7 to 8%, far exceeding growth of Oxygen and Nitrogen. Reference 3, states that some gas production plants are operating inefficiently to produce Argon and that the industrial gas producers are adding Argon capacity in attempt to meet demand.

Bottom Line Effects on Argon Prices: With demand for Argon increasing beyond that for Oxygen and Nitrogen, expect costs to increase. The following are some of the recent price increase public announcements:

1) After Argon prices doubled in recent years, Praxair announced a 15+% increase January 1, 2017 after increasing 35% in 2016!

2) As typical happens all other producers followed their price increases!

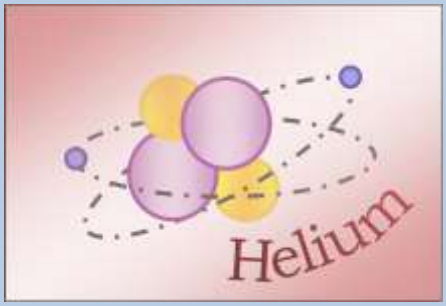
Argon gas mixtures have unique welding properties. When MIG welding steel, they provide: 1) higher weld quality, 2) reduced spatter, cutting post weld cleaning costs, 3) reduced welding fumes and 4) other benefits. Expect Argon to continue to be in demand for welding applications.

The solution to controlling shielding gas costs is to reduce the significant waste the average MIG welder experiences. An article in The Fabricator magazine (reference 4) defined the average MIG welder uses up to 5 times the needed shielding gas. It quantifies the excess gas surge at each weld start as a major cause of gas waste. An article in Trailer Body Builders magazine (reference 5) quotes a representative from Praxair, indicating their fabricator shop survey findings show the average MIG welder consumes 5 to 6 times the amount of shielding gas needed!

Details are presented below about our patented Gas Saver System, which users report typically saves 40 to over 50% of their gas usage.

HELIUM

Unlike Argon, there is virtually no Helium in earth's atmosphere. Helium is a limited worldwide resource. The small amount of Helium available on Earth is produced by radioactive decay in materials like those in granite. Helium is obtained as a byproduct in a limited number of natural gas deposits where it is present in quantities that make it economical to extract. Why does the Helium used not stay in the atmosphere? Because Helium is so light, it escapes the earth's atmosphere and goes into outer space (only 0.0005% is in air!) Helium prices are high and increasing demand for applications such as medical uses, including cryogenically cooled superconducting magnets required for MRI body scanners. Prices can be expected to increase.



Both Praxair and Air Products announced large price increases (~30%) for Helium beginning in 2013. Not only the high price, but because of limited supply, availability of Helium was allocated to a percentage of prior year use.

The CEO of Airgas at the time, (*acquired by the French company Air Liquide in 2016*) Mike Molinini had this to say in a public statement about their availability of Helium in 2012. Summarizing, *"Through January 2012, we secured 90% of our historical helium demand. Our major suppliers then reduced our available helium to 70% of historical demand. Some suppliers were providing less than 60% of their commitments, with one major supplier reducing our allocation to 50%. We had to drop noncontract customers, and were forced to begin allocating to our contract customers."* **(Note: Airgas, now Air Liquide, is the largest gas/welding distributor in the US with about a 1/3 of the retail stores.)**

If you are using Helium or Helium Argon shielding gas mixtures, limited availability may be as important in reducing gas waste, as cutting cost.

BOTTOM LINE

Expect shielding gas prices to rise. The barriers to entry for companies to enter the business are so large it can't happen just because of high market prices. Argon, for example, is less than 1% of the air around us. It cannot be obtained other than to liquefy air and then distill the 0.9% Argon from that liquid. The cost of compressing and liquefying air is the major production cost. Unless a company has the ability and resources to market the Oxygen and Nitrogen it is not cost effective to only produce Argon. In fact, Argon prices would have to be more than an order of magnitude higher to justify the energy waste of liquefying then evaporating the other 99%!

To sell the Oxygen and Nitrogen requires a very large capital investment in liquid gas transportation trucks and large cryogenic cylinders to hold the liquid gas in essential huge vacuum bottles! Even the best insulation causes some of that liquid gas to vent if not in use daily from the tank.

It's not viable to transport this liquid by ship from overseas. Even if that could be done, Argon is in short supply even in China where it is essential for processes such as TIG welding!

The cost of adding two expensive distillation columns to a gas liquefaction plant is very high and becomes a significant cost of a production plant. Many smaller gas liquefaction plants can't justify these extra distillation columns!

WHAT CAN YOU DO?

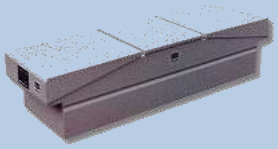
FIRST: HOLD ON TO YOUR WALLET-ARGON PRICES WILL INCREASE

SECOND: CUT YOUR ARGON (AND ARGON/CO_2) SHIELDING GAS WASTE!

OUR PATENTED GAS SAVING PRODUCTS CUT WASTE 50+%

How Much Shielding Gas Can Our Gas Saver System Save in Your Shop?

The best way to show the gas savings and other benefits of our patented Gas Saver System (*GSS ™*) is with examples from our industrial customers.



A Texas Truck Box manufacturer evaluated the *GSS* system on a repetitive job, welding doors. They tested gas usage using two full gas cylinders. With their standard gas delivery hose, they welded *236 doors* with one full cylinder. Just substituting our patented *GSS* for their gas hose, maintaining the same flow settings, they welded *632 doors* with the other! That's a 63% reduction in gas use. Therefore, it would take 2.7 cylinders of shielding gas to weld 632 doors with their standard gas delivery hose. Gas usage savings data from 14 other industrial fabricators is available at: http://netwelding.com/production_test_results.htm

Weld Performance Improvement:

A small shop owner, Al Hackethal, provided this feedback after he purchased a 3 foot *GSS* (Part Number FB3) for his small MIG welder. He reported these findings:

"Well, I can't believe it. I never thought a hose could make that much of a difference. I had a small job that's been waiting for a while. The weld quality, and even penetration is considerable better. Almost no spatter! The weld seemed to be hotter and I turned my MIG down a notch.

Initially thought that my imagination had kicked in, but then realized that the gas I'm buying is actually working the way it's supposed to. Glad I found your website. This is one of the few things that really works better than any info could suggest. I understood the theory, though in practice I understood much better after the first couple of welds. Now I have better looking welds and almost no spatter, which means less grinding and finish work! In addition, the tip was cleaner after the job I just did.

This will provide savings in time, labor and maybe even consumables too. As a one man shop there's never enough time for anything. Thanks for making products affordable".

Another Home Shop Writes About the *GSS* System:

Perry Thomasson has a very well equipped home shop. He uses a 175 amp MIG welder. However, the small welder cart only held a medium size shielding gas cylinder and Perry wanted to reduce the number of times he had to have it filled.

He purchased the largest cylinder his distributor offered for sale and chained it to a wall in his shop. He needed a much longer gas delivery hose so he added a 50 foot conventional 1/4 inch ID gas delivery hose. He found he was using a lot of gas.

Perry purchased a 50 foot long *GSS* and saved a significant amount of shielding gas while improving his weld starts since the peak gas flow surge was also significantly reduced. An orifice is included in the welder/feeder end of the *GSS* that limits peak surge flow so excess turbulence is avoided.

Perry emailed the accompanying picture and said:

"The system works great. Thanks for the professional service and a great product."

About a year after Perry bought his system, his brother bought the same products for his MIG welder. This included leather cable covers, which we also market, to protect the heavy-duty power cable extension cord.

A Professional Street Rod Builder Had This to Say About the *GSS:*

This shop uses a 250 amp MIG welder with a 6 foot gas delivery hose. We tested gas flow at their weld starts and found a 150 CFH peak gas flow that pulled air into the shielding stream causing inferior weld starts with excess spatter. With the *GSS* replacing their existing hose, the peak flow surge at the weld start was 60 CFH and it quickly reduced to the 25 CFH flow setting.

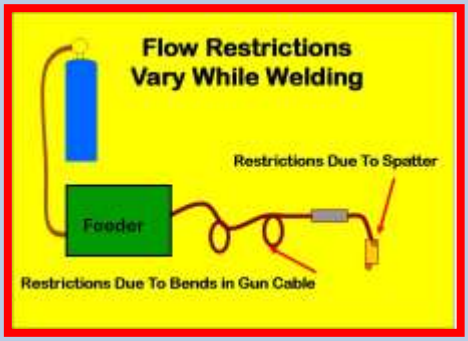
Kyle Bond, President, quickly saw the improvement achieved with weld start quality using the *GSS!* Kyle, an excellent automotive painter, was well aware of the effects of gas surge caused by pressure buildup in the delivery hose. He has to deal with the visible effects in the air hose lines building pressure in the spray gun in his paint booth! It's too bad we can't see the shielding gas waste as Kyle can the effects of excess pressure and flow when he triggers his spray gun! The paint surge is visible and creates defects unless the gun is triggered off the part being painted! Kyle can manage the surge by triggering the paint gun off the part; unfortunately, he can't start welding with the MIG gun off the part! The *GSS* has a built-in surge flow limiting orifice that keeps the peak flow from becoming excessive.

Major Industrial Gas Producer Reduces Helium Gas Waste:

A leading producer and marketer of industrial gases purchased over 250 of our patented ***GSS***'s for their MIG and TIG welders to conserve Helium and save money! Argon Helium gas mixtures are used to fabricate aluminum cryogenic tanks. They also found the ***GSS*** custom extruded hose, because of its unique design, has a significant additional benefit. It has much less moisture permeability! Result, the elimination of porosity problems they previously always encountered in humid weather due to the hydrogen in water vapor! Want more details? Email TechSupport@NetWelding.com

How Does The GSS Work?

Gas waste occurs every time you pull the MIG gun (or TIG torch) trigger, even if only to make tack welds or are inching the wire to cut off the end.



To keep flow at the preset level, the gas pressure in a cylinder regulator/flowmeter is set between 25 and 80 psi. Regulator/ flowgauges (those with a flow calibrated outlet pressure gauge) also operate in this pressure range.) However, to flow shielding gas though the welder and MIG gun (or TIG torch) typically requires only 3 to 7 psi, depending on restrictions. Therefore, every time welding stops the pressure in the gas hose raises to the regulator or pipeline pressure. The increased pressure stores up to 7 times the shielding gas as the physical hose volume. At each weld start, the excess gas contained in the hose *"blasts out"* of the MIG gun nozzle (or TIG cup) at peak flows we have measured can exceed 200 CFH!

The patented ***GSS*** stores over 80% less gas then typical shielding gas hoses. In addition to reducing the wasted gas (which you can hear when you pull the gun trigger), the very high flow causes air to be pulled into the turbulent shielding gas stream created by the high flow. This entrained air produces excess spatter and possibly internal weld porosity.

Turbulent shielding gas flow takes a short time to become smooth, none turbulent (laminar) flow even after the starting peak gas surge reduces. That can take several seconds so at weld starts, when making short welds or tack welds you're not getting all the benefits of the shielding gas purchased! The ***GSS*** incorporates a peak flow rate-limiting orifice in the welder/feeder hose end fitting, controlling peak flow rate and avoiding excess turbulence.

SUMMARY:

The *GSS* can cut shielding gas use in half or more by having 80% less stored gas in its reduced internal volume. It also incorporates a surge restriction orifice built into the fitting at the welder/wire feeder end. That orifice limits peak flow to a level that avoids excess turbulence for better starts. Note, the orifice does not limit any practical flow set on the existing flow control device. A controlled amount of extra shielding gas is still quickly provided to purge the weld start area of air. Welders appreciate the starting benefits.

Simply replace the gas hose from cylinder or pipeline supply to welder/ wire feeder with our patented *GSS*. It is available in various lengths at *www.NetWelding.com* The inexpensive *GSS* will pay for itself in a few months of use. With Helium mixtures, the payback is measured weeks.

REFERENCES

1. MIG Welding Handbook, ESAB Welding & Cutting Products, October 1996.
2. Ludwig, H. C., Nitrogen Effects in Argon Arc Welding Atmospheres, The Welding Journal, Vol. 34, Number 9, September 1955.
3. Garvey, M.D. & Turley, C.E., CryoGas International, July 2011
4. Standifer, L. R., Shielding Gas Consumption Efficiency. The Fabricator, Vol. 30, Number 6, June 2000.
5. Weber, R., How to Save 20% on Welding Costs. Trailer/Body Builders, Vol. 44, Number 3, January 2003.

About the Author

Jerry Uttrachi is President of WA Technology, a company he founded in 1999 dedicated to helping companies reduce costs, improve weld quality and welding productivity. Four of six recent products he invented and patented, relate to reducing shielding gas waste and improving weld quality. Two welding helmet patents, granted in 2012 and 2013, provide filtered breathing air that is also cools a welder, employing thermoelectric cooling modules.

Mr. Uttrachi started his career in the welding field over 45 year ago in R&D at the Linde Welding and Cutting Laboratory. At the time, it was a leading company developing welding gases, filler metals and equipment. (Linde a US company was a Division of UCC. It was renamed Praxair when they divested of the welding equipment, cutting machine and filler metals businesses in the 1980's. Ironically they were just purchased by a Germany company, Linde AG!) After managing the companies Material Technology Laboratory developing welding shielding gases and filler metals, he became Director of Welding Market Development. When the welding division became a separate company, he was named Vice President of Marketing for the newly formed company, L-TEC, a name he coined! He was responsible for Business/Product Management, Marketing, Communications and Customer/Technical Service. When the business was acquired by ESAB in 1989, he remained in that position for the L-TEC brand and for ESAB's Equipment business. In 1999, he left to form WA Technology.

As an active volunteer of the American Welding Society, Mr. Uttrachi has served on numerous volunteer committees including recently being on the AWS Board as Director at Large, three years as Vice President and the 2007 President of the Society. He served as Chair of the Societies Education Foundation Board through 2014. He is currently a member of several AWS committees, including the Technical Advisory Committee (TAC) that reviews all Welding and Materials Standards and other Welding Practices documents.

He is a life member of the American Society of Mechanical Engineers and Chair of his local ASME Section.

He holds a Bachelors and Masters degree in Mechanical Engineering and a Masters in Engineering Management from New Jersey Institute of Technology.