Industrial gases are as vital as water and electric power. Even in everyday life.

Nitrogen, oxygen and more.
What are industrial gases?

Industrial operations require oxygen, nitrogen, argon, xenon, neon and krypton, along with carbon dioxide, acetylene, hydrogen and helium and a wide variety of gas mixtures. At Messer we call these gases Gases for Life. They are produced in large-scale industrial plants and are just as important as water and electric power for many manufacturing processes which make everyday products.

Where do they come from?

Oxygen, nitrogen, argon, xenon, neon and krypton are produced from the air. Carbon dioxide is primarily collected from the exhaust of industrial operations and cleaned. In some cases it is also produced from natural underground sources. Hydrogen and acetylene are produced chemically. Helium is extracted from underground sources.

How are gases produced from air?

In order to produce these gases, we use air separation units which are 60 metres high or more. Inside them, a physical process takes place which separates the air into its components. That process, which is also known as low-temperature rectification, basically works like this:

Atmospheric air from the surroundings is

- filtered (dust is removed) and compressed to about 6 bars
- pre-chilled with cooling water
- dried and stripped all of CO₂ in a molecular sieve
- cooled to below -175°C and liquefied in the main heat exchanger
- separated into liquid or gaseous oxygen and nitrogen in a separating column
- also separated into liquid argon

The gases are stored in liquid form in tanks.
In smaller quantities, gases are stored in pressurised gas cylinders. When industrial gases are needed in large quantities, we install tanks at our customer’s plant. Those tanks are used to store gases such as oxygen, nitrogen, argon or CO₂ in liquid form. Tanker trucks and railway tanker cars are used to transport the gas from the production plants to the customer.

Major industrial concerns such as steel works or chemical companies need so much gas that they often have an air separation unit operating on their grounds. Sometimes pipelines are also used to supply gases to one or more major facilities, such as in industrial parks.

The greater the quantity of gases which a consumer needs, the shorter the distance should be between the customer’s site and the location where the gases are produced. Generally speaking, gases are produced where they are needed: close to densely developed industrial areas.

**How do Gases for Life reach the customer?**

Messer is the world’s largest privately run industrial gas specialist. Adolf Messer established the company in 1898, and his grandson, Stefan Messer (photo), is in charge of the company today. He and the more than 5,000 employees in Europe and Asia work according to clearly defined principles. Those principles include customer and employee-orientation, responsible action, entrepreneurial responsibility, excellence, as well as trust and respect. The headquarters of the family-run company are located in Bad Soden near Frankfurt, Germany.

**Who is the Messer Group?**

Industrial gases are used in a variety of purity grades and for a wide range of purposes. Including as food gases and medical gases. Industrial gases can make production processes safer and more cost-effective and improve product quality. They often contribute to environmental protection. Some processes and applications would even be inconceivable without the chemical processes of gases. Typical user sectors include the automotive industry, the steel industry, environmental engineering, food and beverages, construction, metallurgy, glass and ceramics, medicine and pharmaceuticals, the chemical industry, and research and development.

**Who needs Gases for Life?**
More than half of the part of our planet which is accessible to humans – 50.5 per cent, to be exact – consists of oxygen. That’s the share of this element in the atmosphere, the hydrosphere (waters) and the Earth’s crust down to a depth of 16 kilometres. So based on its mass alone, this makes oxygen the most important foundation of our world.

The term “oxygen” is the result of a mistake in early natural science. The pioneers of chemistry in the 18th century thought that the colourless and odourless gas was responsible for the formation of acids. So they named it “oxygénium” (acid-forming agent), derived from the Greek word for acid: “oxys”.

Out in space, by the way, oxygen is the third most common element after hydrogen and helium, albeit in a far lower proportion than here on Earth. It makes up about 0.8 per cent of our solar system. Industrial operations take advantage of the reactive properties of oxygen in order to manufacture products as efficiently and cost-effectively as possible: oxygen is involved in most industrial processes in which combustion or chemical reactions play a role – from steelmaking to water treatment.

Medical oxygen plays an important role as a breathing gas.
As an essential component of amino acids, nitrogen is a basic element of all life. Without the element with the symbol N, there would be no metabolism, no protein and no DNA – neither in plants nor in animals or humans. Nitrogen represents nearly two kilograms of the total weight of a 70-kilogram adult.

The German word for nitrogen – Stickstoff – shares etymological roots with the German word for suffocation or asphyxiation and derives from nitrogen’s ability to extinguish flames as well as life. The scientific name “nitrogenium” derives from the Greek word for salt peter (“nitros”) from which it was produced before the invention of air separation.

99 per cent of the Earth’s supply of nitrogen is found in the air. Most plants require fixed nitrogen compounds which are contained in the soil and consumed by them. That’s why more than eighty per cent of worldwide nitrogen production – some 40 million tonnes per year – is used to manufacture synthetic fertilisers.

Pure nitrogen is used for many purposes, including as a gas to fill aircraft tyres so the wheels do not catch fire due to the heat generated during takeoff and landing. The gas also serves as a propellant – to whip cream, for example – or as a shielding gas in food packaging.

Liquid nitrogen is used as a cooling medium in cryogenics – for food storage, for example, or for flash freezing. Other application areas for liquid nitrogen include concrete cooling and ground freezing in construction along with cryosurgical applications. The best-known example of the latter is the freezing of warts.

In the manufacture of electronic components, e.g. for MP3 players, nitrogen is used as a shielding gas.
The group of noble gases includes helium, neon, argon, krypton and xenon along with radioactive radon and ununoctium (whereby the latter can only be generated synthetically). These gases are referred to as “noble” because – exactly like the noble metals gold, silver, platinum, etc – they form almost no chemical bonds under normal conditions. That’s why noble metals stay shiny and retain their “noble appearance” for a long time. By comparison, noble gases are even more “inert” and are therefore aptly named.

The noble gas most commonly found on Earth is argon (Ar). The air that surrounds us comprises barely one per cent argon. It is mainly used in the welding of aluminium alloys or special steels. In such cases it is used as a shielding gas, often in a mixture with other gases: argon shields the welding area from oxygen, which enhances the quality and durability of the welds.

The best-know application of helium (He) is probably free-floating party balloons. But helium also has a whole range of other important applications. For example, supercooled liquid helium is used in medicine as a coolant for the superconducting magnets of MRI scanners. Like argon, it is also used as a shielding gas, and it is also the most commonly used tracer gas in leak detection.

Krypton (Kr), xenon (Xe) and neon (Ne) are mainly used as fill gases and operating gases in lamps and lasers. The xenon headlights used in automotive construction are one well-known example. Not only are they significantly brighter than halogen headlights, but they also last longer. The gas which gives them their name, xenon, is required for a discharge process which produces the bright light. But halogen lamps are filled with noble gas mixtures, too. Xenon and neon are also the main components in the fill gas of plasma display screens.

In addition, krypton serves as a fill gas for double glazed windows: Filling the space between the panes with krypton provides significantly better insulation properties than when it is filled with air or argon.
Plants cannot grow without CO₂, which makes it an indispensable prerequisite for higher life.

Along with water, plants contain mainly carbon compounds. They draw the carbon they need for their roots, stems, leaves and fruit from the share of CO₂ found in the air. Plants, in turn, form the nutritional basis for the entire animal world, including humans.

And over the course of hundreds of millions of years, that biomass also transformed into the huge reserves of carbon, oil and natural gas, which man is now burning back into CO₂ with increasing speed. That’s why the share of carbon dioxide in the air is increasing and its thermal insulation effect is contributing to global warming.

Some of those CO₂ waste gases are collected again and reused in another process. The best-known among them is the enrichment of soft drinks, which owe their sparkle to the gas.

In the form of dry ice, it is used for cooling and freezing. And it is playing an ever increasingly important and extremely eco-friendly role in the treatment of drinking water and in wastewater neutralisation. Unlike the aggressive mineral acids which are otherwise used, it leaves no problematic residues behind.

When used in greenhouses, the carbon dioxide is converted back into biomass, because the plants draw carbon from it for their growth and release the oxygen.

Applications
Additive in soft drinks; treatment of drinking water; wastewater neutralisation; greenhouse fertiliser; coolant; cleaning agent (as dry ice); cooling medium, e.g. for catering or transport cooling (dry ice); firefighting, paper recycling.
Good morning,  
Gases for Life

Messer’s current ad campaign focuses on the benefits of industrial gases in everyday life. The advertising image “Breakfast” illustrates the use of nitrogen (N₂) for, among other things, the preparation of finely ground spices or the optimal packaging of cheese. Carbon dioxide (CO₂) is used, for example, to fertilise vegetables, to chill dough or to decaffeinate coffee – and of course as sparkling carbon dioxide in beverages. Oxygen (O₂) is used in the production of glass, and ozone (O₃) helps bleach paper in an eco-friendly way.

Further information is available at:
www.messergroup.com
www.specialtygases.de