

Making our world more productive



Managing refrigerants the responsible way.

Products and services to meet rising environmental standards.



The environmental challenge.

As with all human activities, refrigeration and air conditioning applications have an impact upon the environment, contributing to ozone depletion and global warming. Legislation is phasing out harmful refrigerants, replacing them with more eco friendly alternatives. In many countries there is further legislative focus on lowering emissions by reducing charge sizes within refrigeration systems, improving equipment design and driving better maintenance and inspection procedures.

Users of refrigeration and air conditioning systems have also come to recognise their ethical obligation to protect the environment, and are demanding solutions to meet them.

Linde provides practical support to our customers to help meet these needs by offering a wide range of eco friendly products and related services.

Reducing environmental impact

The refrigeration and air conditioning industry is focused on reducing the environmental impact in two key areas:

- Reducing the direct emissions of refrigerant gas into the atmosphere that can lead to ozone depletion and global warming
- Reducing the indirect emissions of greenhouse gases caused by refrigeration equipment power consumption that can lead to global warming

Linde's position

Linde Gas is a global leader in refrigerant solutions and services. Our products span both traditional fluorocarbon and natural refrigerants making us a trusted partner to a vast range of industries around the world.

At Linde, we are committed to the responsible use of natural resources, the development of clean technologies and the replacement of harmful substances with eco-friendly alternatives.

Linde supports the establishment of global legislation to phase down the most damaging refrigerants as well as the development and commercialisation of new generations of more environmentally friendly refrigerants.

Linde also plays a practical role in driving a reduction in both direct and indirect emissions through a number of activities, including providing support on the refrigerant choice, understanding system efficiency and waste management via our refrigerant recovery and reclaim solutions.

Refrigerant choice

Linde strongly advocates the use of refrigerant gases with zero ozone depletion potential and fully supports the phase out of ozone depleting gases (HCFC's) occurring globally as part of the Montreal Protocol.

Linde also advocates the use of lower global warming potential gases where they contribute to a reduction in the Total Equivalent Warming Impact (TEWI) of a system from direct and indirect emissions. Linde provides a wide range of refrigerant gases, including lower GWP alternatives.

The table overleaf provides a summary of the direct environmental impact of a number of common refrigerant gases. Both natural refrigerants, HFC and HFO fluorocarbon refrigerants offer effective solutions to lower direct emissions.

Lowering your emissions

Environmental responsibility extends far further than the selection of a suitable refrigerant gas. It is important to manage other aspects of a refrigeration or air conditioning system including:

- Optimising system energy efficiency
- Reducing refrigerant charge sizes
- Improved maintenance and inspection regimes
- Minimising system leakage

Management of these activities is increasingly becoming a legal requirement in many geographies. Linde supports these initiatives and can assist you in meeting these needs, such as providing analytical services to ensure your refrigerant is of high purity to maximise system energy efficiency.

| Refrigerant type | Refrigerant name | ODP ¹ | GWP ² | Comments |
|----------------------|------------------------|------------------|------------------|-----------------------------------|
| CFC | R11 | 1.00 | 4,750 | Very high ODP and very high GWP. |
| | R12 | 0.82 | 10,900 | No longer sold. |
| HCFC | R22 | 0.06 | 1,810 | Medium ODP and medium GWP. |
| | R124 | 0.03 | 610 | Phasing out via Montreal Protocol |
| HFC | R134a | 0 | 1,430 | Zero ODP, medium GWP. |
| | R404A | 0 | 3,920 | |
| | R407C | 0 | 1,770 | |
| | R410A | 0 | 2,090 | |
| | R422D | 0 | 2,730 | |
| HFO | R1234yf | 0 | 4 | Zero ODP, low GWP |
| Natural refrigerants | R717 | 0 | 0 | Zero ODP, low GWP |
| | R744 | 0 | 1 | |
| | Hydrocarbons e.g. R290 | 0 | <20 | |

¹ Ozone depletion potential, UNEP (2006). R11 = 1

² Global warming potential (100 year), IPCC 2005, 2007. CO₂ = 1

Waste management: refrigerant recovery and reclaim solutions

Linde encourages the recovery, reclaim and reuse of refrigerants wherever possible. This enables you to meet your environmental obligations by:

- Avoiding the atmospheric release of refrigerant gases
- Eliminating the need to produce new refrigerant gases
- Reducing impurities within the refrigerant system, increasing operating efficiency

Linde has proven expertise to enable this process. We provide comprehensive, cost-effective recovery and reclaim services tailored to the needs of all refrigeration systems – large or small:

- Supply of recovery cylinders that enable on-site customer collection
- Direct collection of larger volumes in drums or ISO containers
- On-site recovery and system rectification service (selected geographies)
- Refrigerant reclamation
- Environmentally friendly waste destruction services
- Consultancy – assistance with legal requirements including waste gas management, certification and environmental reporting
- Certification of treatment – legal proof of responsible care

Technical support

Linde offers substantial technical support to assist in understanding the refrigerant choices available to meet goals of reducing environmental impact. Linde can provide detailed information on refrigerant gas properties to help you understand the environmental impact as well as operating capabilities. Linde also provides advice on retrofit options, where the refrigerant gas used within a refrigeration system is changed to one of a lower environmental impact, through to information on refrigerant gases suitable for use in new environmentally friendly equipment.

Linde also supports queries on the safe handling and use of the new generation of HFO and Natural Refrigerants. These gases have different physical properties to traditional fluorocarbon refrigerants such as flammability, toxicity or higher operating pressures.

Further information

For further information regarding how Linde can help you meet your environmental needs, please contact your local Linde supplier.

Alternatively visit www.linde-gas.com/refrigerants

