Eco-friendly refrigerants

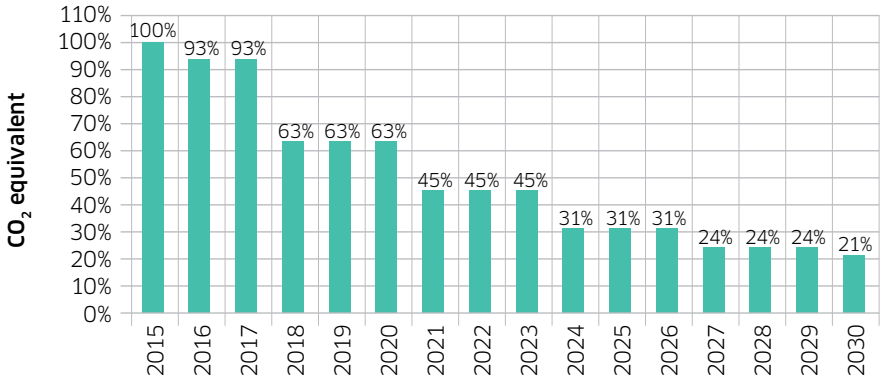
Many of the refrigerants that used to be in common use are affected by usage bans in the Montreal Protocol and by the phase-down specified in the F-gas Regulation. This is because such refrigerants have an ozone depletion potential (ODP > 0) and/or are environmentally harmful greenhouse gases that contribute to global warming (high GWP value).

But there are alternatives: the group of synthetic hydrofluoroolefin (HFO) refrigerants, such as R-1234ze, and the group of natural refrigerants, such as ammonia (R-717) or carbon dioxide (R-744), for example.

Eco-friendly refrigerants considerably reduce the direct emissions and thus the CO_2 footprint of chillers and heat pumps. Furthermore, HFOs combine low direct emissions with low indirect emissions if highly efficient oil-free radial turbo compressors are used.

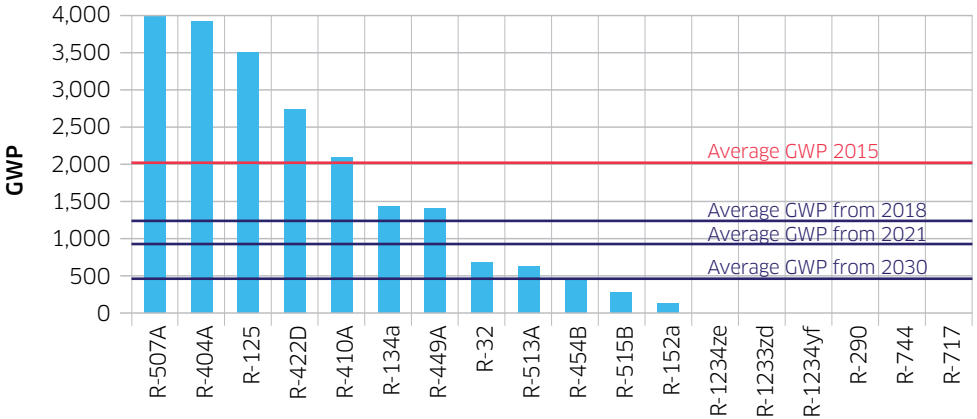
Each refrigerant has its own specific chemical and physical properties that distinguish it for its particular area of application.

Phase-down as per Regulation (EU) No. 517/2014 (F-gas Regulation)



The CO_2 equivalent in the European Union is being incrementally lowered and restricted by the F-gas Regulation. (CO_2 equivalent = GWP value x filling volume)
The lower the GWP value, the lower the CO_2 equivalent.

Estimated resulting average GWP in the EU for the phase-down



Source: ENGIE Refrigeration – based on GWP values from the IPCC and data from EEA European Environment Agency (2017): Fluorinated greenhouse gases, Report No. 20/2017, Luxembourg.

The lower the GWP value, the more sustainable the refrigerant.

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	R-744 (CO_2)	R-717 (Ammonia)	R-134a	R-513A	R-1234ze	R-515B	R-454B	R-1233zd	R-22
ODP value (ozone depletion potential)	0	0	0	0	0	0	0	0.00034	0.055
GWP value AR4 rating*	1	0	1,430	631	7	293	466	4.5	1,810
GWP value AR5 rating**	1	0	1,300	573	<1	299	467	1	1,760
Safety class DIN EN 378-1	A1	B2L	A1	A1	A2L	A1	A2L	A1	A1
Toxicity	low	high	low	low	low	low	low	low	low
Flammability	non-combustible	low flammability	non-combustible	non-combustible	low flammability	non-combustible	low flammability	non-combustible	non-combustible
Availability until 2030 relating to Regulation (EU) No. 517/2014 and the Montreal Protocol	yes	yes	yes	yes	yes	yes	yes	not assured	no
Restrictions	No restrictions specified in current legislation	No restrictions specified in current legislation	Restrictions regarding availability and price increases due to tightening on the basis of the F-gas Regulation already apply	Restrictions regarding availability and price increases due to tightening on the basis of the F-gas Regulation already apply	No restrictions specified in current legislation	No restrictions specified in current legislation	No restrictions specified in current legislation	Ban due to ozone depletion potential (see R-22 ban), ban on the placing on the market in Switzerland as per BAFU already apply	Ban on the placing on the market due to ozone depletion potential
Implemented in the ENGIE Refrigeration product portfolio	thermeco$_2$	AMONUM	QUANTUM	QUANTUM	QUANTUM	QUANTUM	PENSUM	not used by ENGIE Refrigeration	not used by ENGIE Refrigeration
Benefits	Long-term availability	Excellent physical properties (high specific and volumetric refrigerating capacity)	Can be used in oil-free highly efficient turbo compressor technology	Can be used in oil-free highly efficient turbo compressor technology	Can be used in oil-free highly efficient turbo compressor technology	Can be used in oil-free highly efficient turbo compressor technology	Increased efficiency of approx. 5% compared to predecessor refrigerant R-410A		
	Lowest safety requirements due to A1 classification	No ozone depletion potential and no greenhouse gas effect	Lowest safety requirements due to A1 classification	Lowest safety requirements due to A1 classification	Easy to implement safety requirements	Lowest safety requirements due to A1 classification	Easy to implement safety requirements		

GWP = global warming potential in relation to CO_2 (CO_2 = 1, per definition)
* GWP as per IPCC (AR4) and F-gas Regulation (EC) No. 517/2014
** GWP as per IPCC (AR5)

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