Why R32 is the right Choice for the Future

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GREENHOUSE EFFECT

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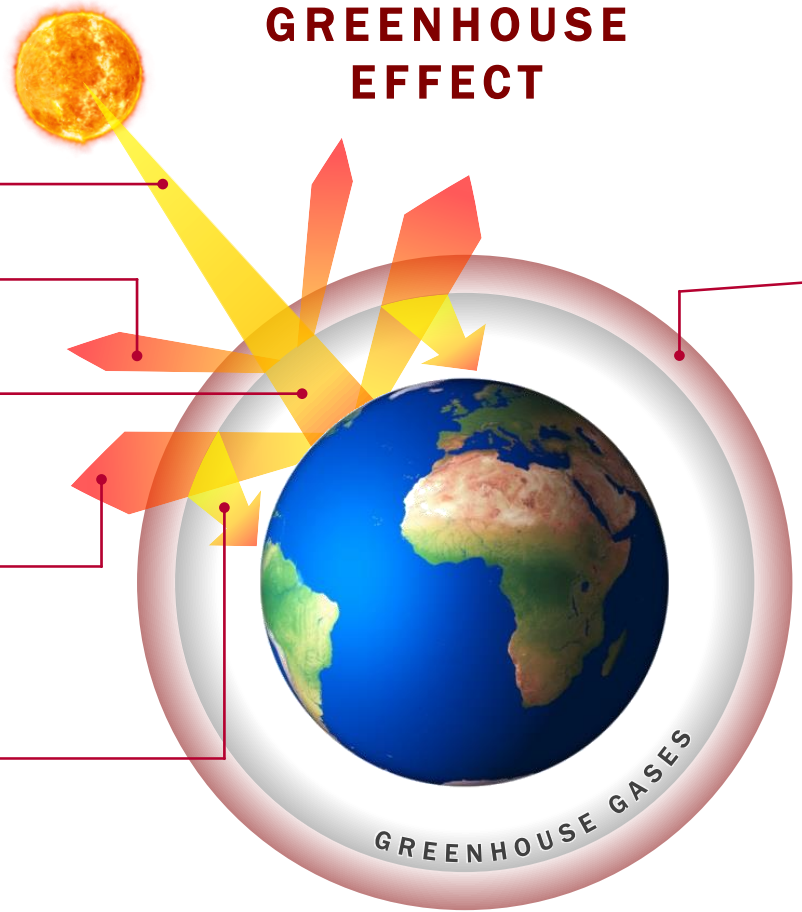
When solar radiation reaches the atmosphere

part of it is reflected to space

while other part is absorbed by the planet surface and warms it

This absorbed heat would eventually radiate back to space if wasn't for greenhouse gases

They trap the heat within the atmosphere and maintain Earth's surface warm enough to sustain life on the planet



Human activities increases the Greenhouse effect, allowing the atmosphere to absorb and trap even more heat than usual, raising Earth's temperature creating so-called Global Warming

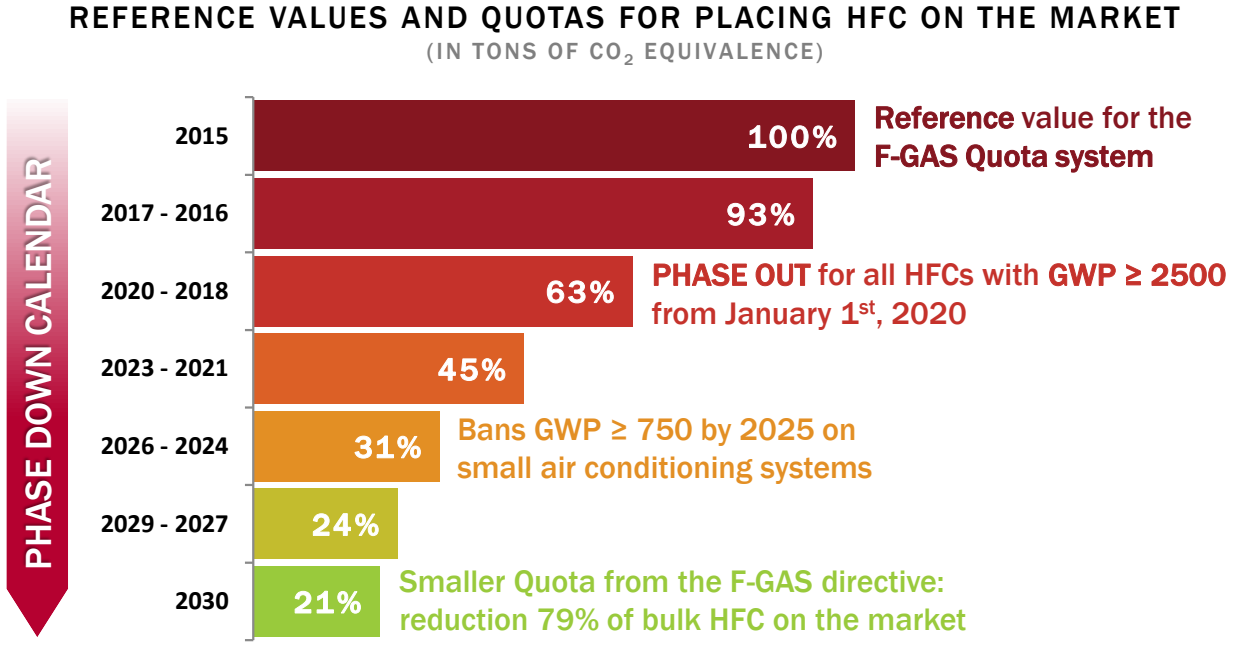
Global Warming is a consequence of a long-term increase of the Earth's temperature that causes serious side effects on the weather and on the environment

F-GAS DIRECTIVE

related to the EU regulation No. 517/2014

Entered into force during January 2015, to contribute to the reduction of the global warming by limiting the use of HFCs

High GWP refrigerants may have a speculative price increase after each quota, due to the reduced availability of bulk HFC on the market



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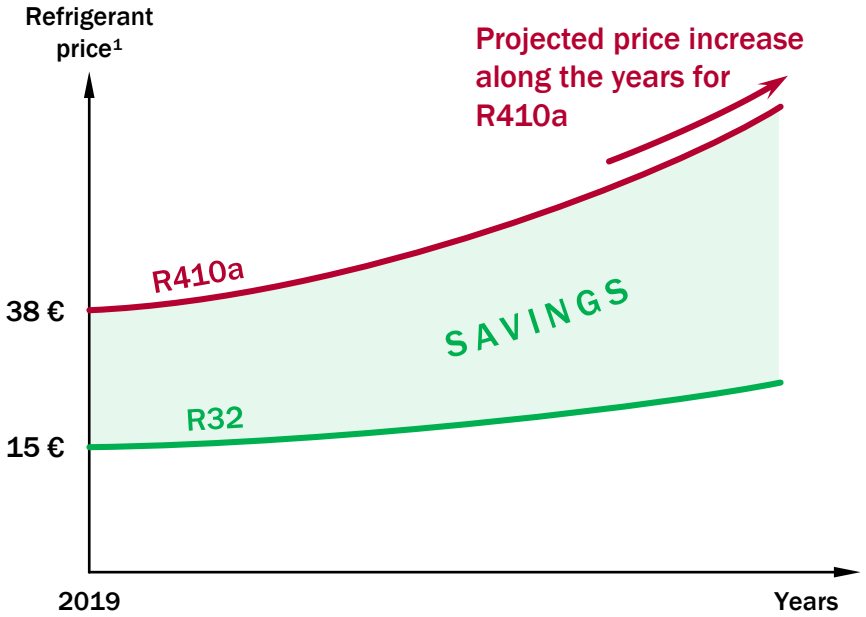
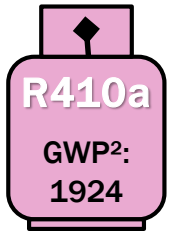




1. Average price for French market (2019)
2. GWP values based on the IPCC 5th assessment report

REFRIGERANT COMPARISON

R32

GWP 677
ODP 0

Low charge refrigerant:
- ✓ Up to 30% charge reduction on the total thermodynamic circuit

Single component substance:
- ✓ No glide
- ✓ Easy to handle and recover in case of a leakage

Availability:
- ✓ Readily available on the local market
- ✓ Low price and easy to source

ASHRAE safety group: A2L

Composition:
- ✓ 100% Difluoromethane (HFC)

R452B
GWP 676
ODP 0

Non-Azeotropic blend with glide:
- Require vacuum and new charge when leakage is detected

Patented substance:
- High price and lower availability

ASHRAE safety group: A2L

Composition:
- 67% of R32 (HFC)
- 26% of R1234yf (HFO)
- 7% of R125 (HFC)

R454B
GWP 466
ODP 0

Non-Azeotropic blend with glide:
- Require vacuum and new charge when leakage is detected

Patented substance:
- High price and lower availability

ASHRAE safety group: A2L

Composition:
- 68,9% of R32 (HFC)
- 31,1% of R1234yf (HFO)

R466A
GWP 696
ODP > 0

Non-Azeotropic blend with glide:
- Require vacuum and new charge when leakage is detected

Patented substance:
- High price and lower availability

ASHRAE safety group: A1

Composition:
- 49% of R32 (HFC)
- 11,5% of R125 (HFC)
- 39,5% of 13L1 (fire suppressor)

 GWP values based on the IPCC 5th assessment report

SAFETY GROUPS

The main concerns about these transition refrigerants is their flammability risk

ASHRAE SAFETY CLASSIFICATION

A1 R410A R134A R513A	**B1**	**NO FLAME PROPAGATION**
A2L R32 R1234ze	**B2L**	**LOWER FLAMMABILITY** • low burning velocity • low heat of combustion
A2	**B2** R717	**LOWER FLAMMABILITY**
A3 R290	**B3**	**HIGHER FLAMMABILITY**
LOWER TOXICITY	**HIGHER TOXICITY**	

INCREASING FLAMMABILITY

INCREASING TOXICITY

TRANSITION TO A2L CLASS

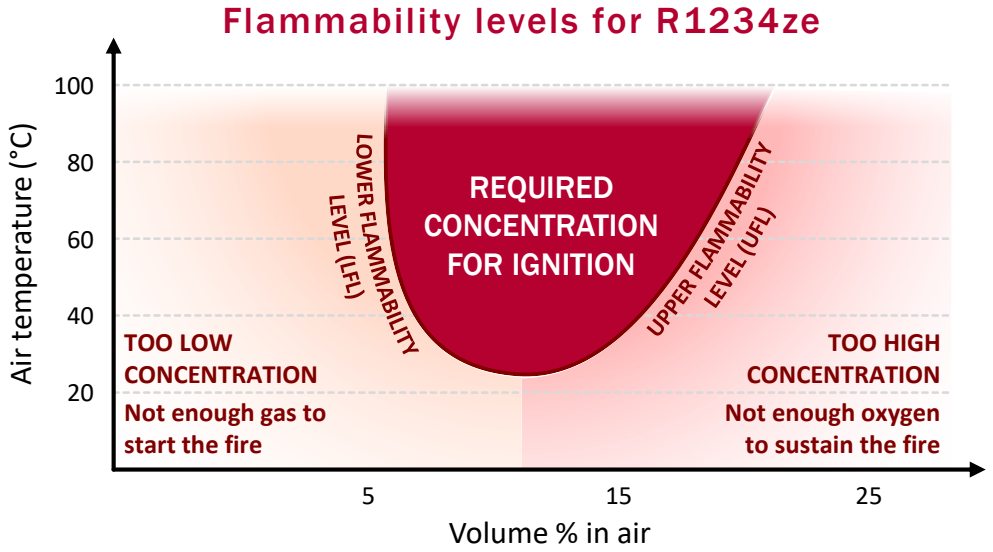
Even being classified as mildly flammable, the A2L refrigerants present a low risk of ignition, due to its low burning velocity (<10 cm/s) and its low heat of combustion (<19 MJ/kg).

LOW RISK

IGNITION CONDITIONS FOR FLAMMABLE GASES

1ST CONDITION: CONCENTRATION

All flammable substances have a Lower and an Upper flammability level (LFL and UFL). Those limits represents their minimum and maximum concentration levels required to start a fire.



R32

- The LFL for R32 is 14% (or 300g/m³).
  This concentration is so high that this is also the concentration level for any foreign gas in air to reach the accepted oxygen deprivation safety limit.

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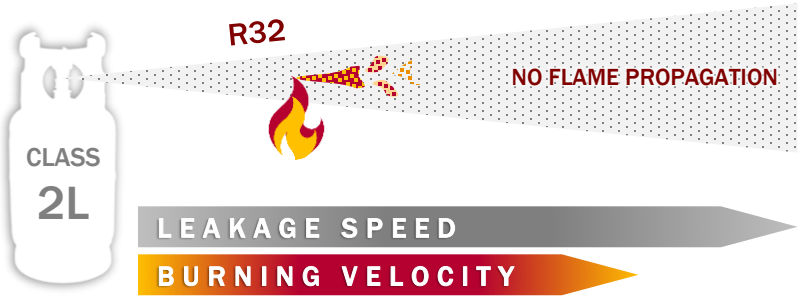
2ND CONDITION: BURNING VELOCITY

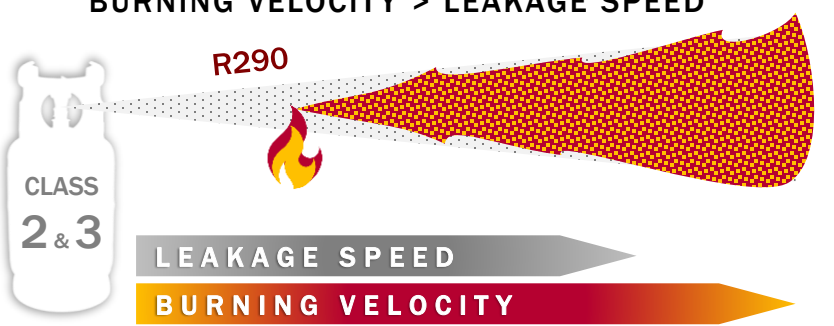
To sustain the fire, the velocity of the leaking refrigerant must be lower than its burning velocity, otherwise the fire won't be able to propagate itself and will fade out.

The burning velocity for **R32** is 6,7cm/s, which is almost a stationary condition. Since R32 is heavier than air, any leaked refrigerant will exceed this minimum velocity due to the effect of gravity.

LEAKAGE SPEED > BURNING VELOCITY



BURNING VELOCITY > LEAKAGE SPEED



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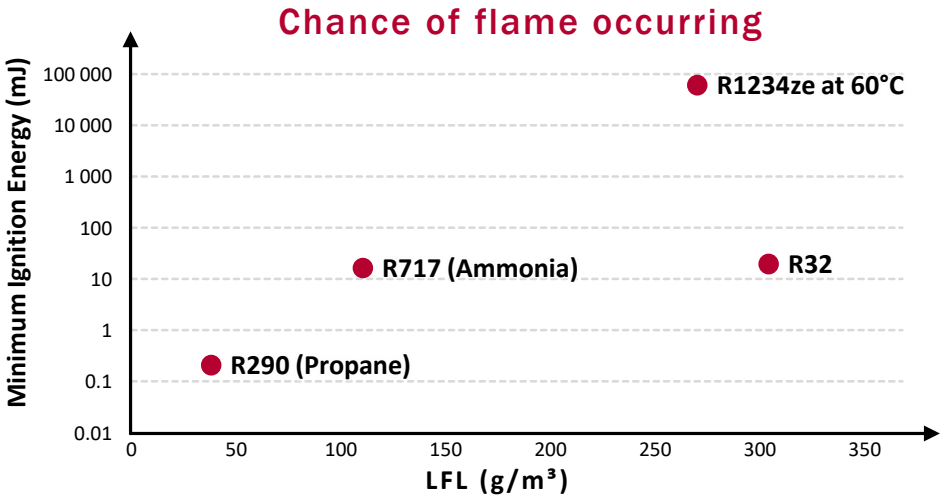
3RD CONDITION: IGNITION ENERGY

If the two first conditions are meet, a minimum ignition energy will be required to start the fire.

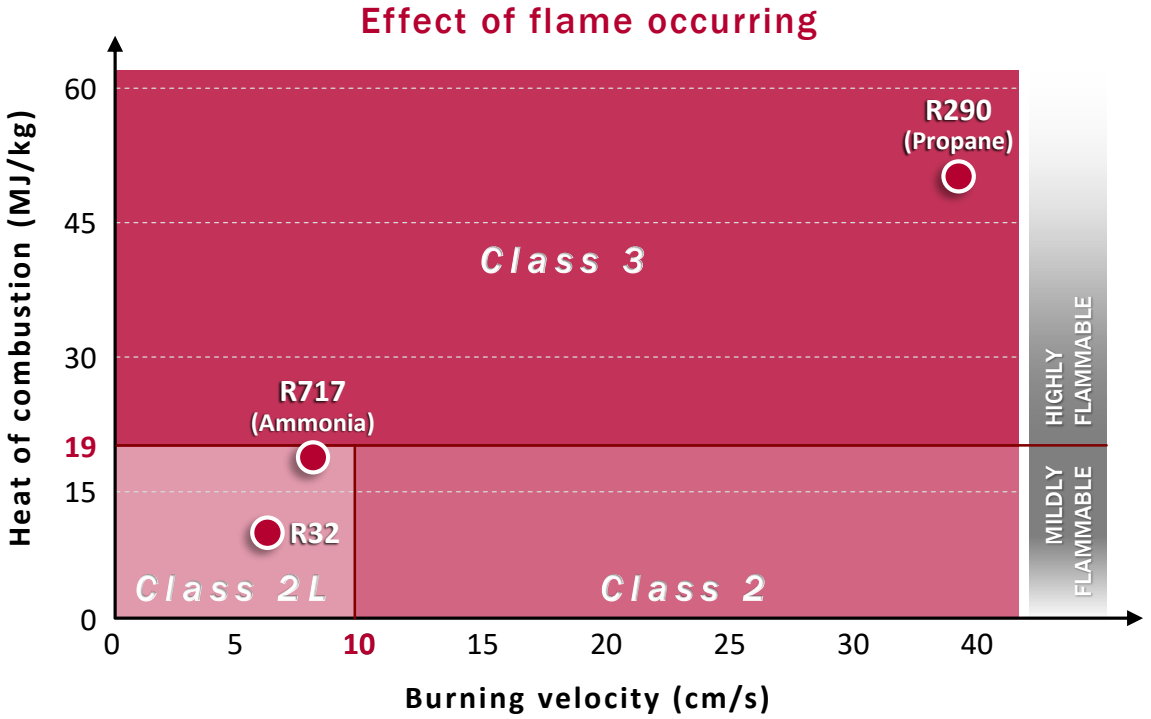


R32 cannot be ignited by ordinary sparks from light switches, static or other electrical components. It will probably need a naked flame at floor level to start the fire, as R32 is heavier than air.

FLAMMABILITY RISK FOR A2L CLASS

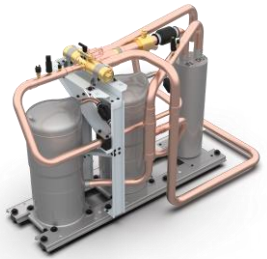
Despite the A2L safety classification (mildly flammable), there is a really low risk of ignition with **R32**.

Even if A2L refrigerants ignite, the effect of the flame will be extremely mild, due to their low heat of combustion, which is about 5 times lower than propane.



30% REDUCTION REFRIGERANT CHARGE

- New Exchanger
- New piping design
- New compressors
- New refrigerant



Multi-scroll compressor assembly (tandem)

Better efficiency
Low GWP solution

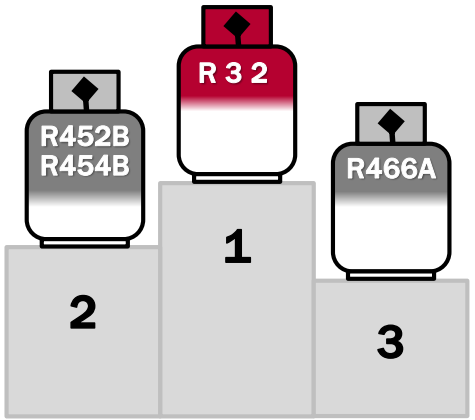
NEW COIL GENERATION DESIGN:

- ✓ New tube geometry
- ✓ New fin design
- ✓ New circuiting

Thanks to its properties, R32 stands out as the best alternative to R410A.
R32 selected by Lennox provides the highest performance and safety at the lowest cost.

	R32	R452B / R454B	R466A*
Composition	Single component fluid	Blend containing R1234yf	Patented blend of R32, R125 an CF31
Flammability	Mildly flammable (A2L class)	Mildly flammable (A2L class)	Not flammable (A1 class)
Glide / Blend	No	Yes	Yes
Need for vacuum	No	Yes	Yes
Patented	No	Yes	Yes
Allowed in EU	Yes	Yes	Yes
Price	£	££	£££

*Still under evaluation



WHY NOT CHOOSE NATURAL REFRIGERANTS INSTEAD?

All the main natural refrigerants have physical properties which can make them difficult to handle:

R290 (PROPANE)
Is highly flammable, with a high risk of explosion

CO2
Demands high pressure, means high energy consumption, and incurs additional installation cost.

AMMONIA
Is highly toxic, and there are regulations limiting its use

Q & A