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PORTUGUESE
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F-GAS AND NATURAL REFRIGERANTS: PORTUGUESE OVERVIEW

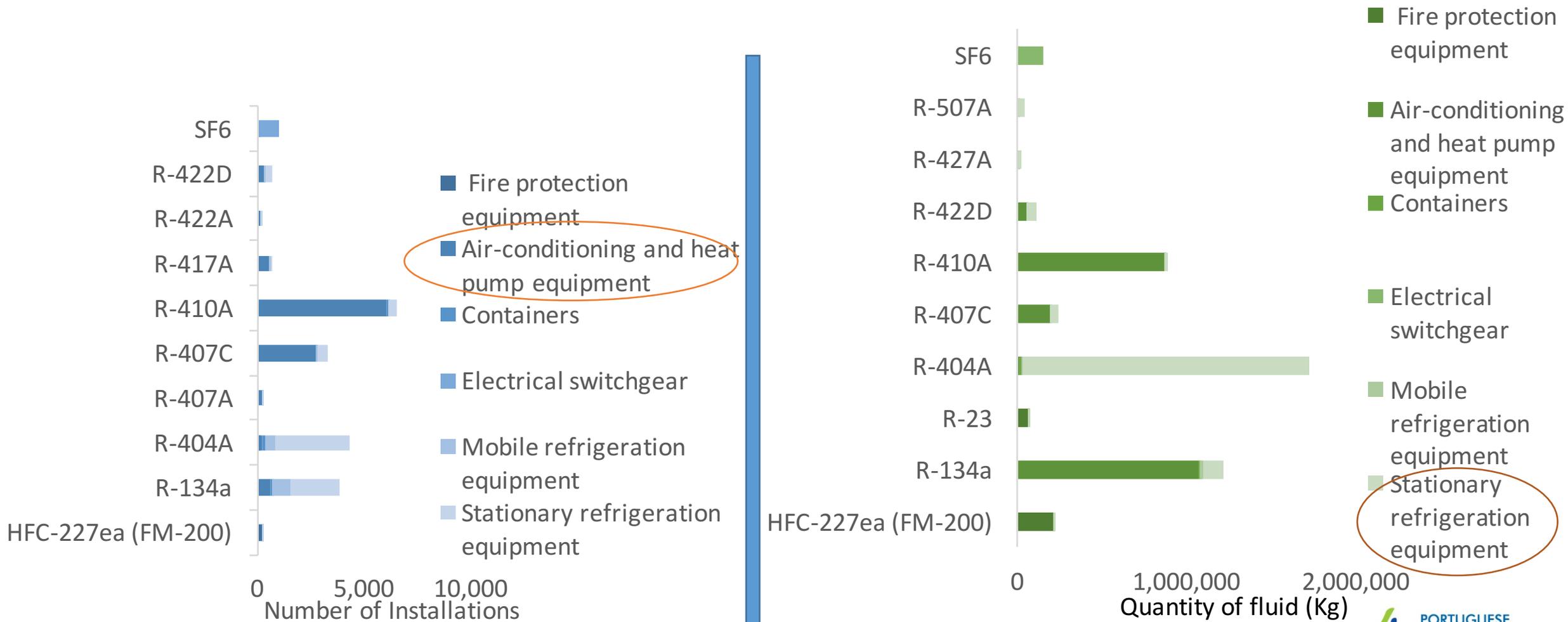
CHALLENGES TO NATURAL REFRIGERANTS TRANSITION

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PORTUGUESE F-GAS FLUIDS DISTRIBUTION BY EQUIPMENT AND INSTALLATION (2014)



PORTUGUESE F-GAS FLUIDS DISTRIBUTION BY EQUIPMENT AND INSTALLATION

Most currently used refrigerants

- in the RACHP sector are: R-404A, R-422D, R-134A, R-407C and R-410A;
- in the commercial refrigeration sector are: R-404A, R-422D, R-134A, R-427A, R-407C, R-744, NH3 and R-290.

Portugal does not have specific restrictions on applications, but safety requirements, in order to ensure safety at work, which increases investments on the facilities.

Affected refrigerants (in refrigerating equipment) are as follows:

- R-290
- NH3

NATURAL REFRIGERANTS: STATE OF THE ART

- According to the distribution sector, there are no tested technologies (with a lower GWP) to be safely and efficiently used in centralised refrigerating systems (super and hypermarkets);
- There are no technologies using natural refrigerants that are cost-effective, in countries with warmer climates such as Portugal;
- Some refrigerants cannot be used because of restrictions related to safety;
- Using R-290 in a centralized system would require a significant amount of gas.

NATURAL REFRIGERANTS: STATE OF THE ART

- The Portuguese law (Decrete-Law n.º 56/2011) is being amended according to the Regulation (EU) 517/2014, Regulation (EU) 2015/2065, Regulation (EU) 2015/2066, Regulation (EU) 2015/2067 and Regulation (EU) 2015/2068;
- At the moment it is not foreseen financial support to the natural refrigerants implementation, which does not mean that it cannot be done in the future;
- There is already one formation center (APIEF), that ministers formation on the natural refrigerants area, involving 31 technicians, with contents that include CO₂, NH₃ and Hydrocarbons.

NATURAL REFRIGERANTS: STATE OF THE ART

CO₂ properties compared with various refrigerants

Refrigerant	R134a	R404a	NH ₃	CO ₂
Natural substance	NO	NO	YES	YES
Ozone Depletion Potential (ODP) *	0	0	0	0
Global Warming Potential (GWP) *	1300	3260	-	1
Critical pressure in	bar	40.7	37.3	113
	°C	101.2	72	132.4
Triple point in	bar	0.004	0.028	0.06
	°C	-103	-100	-77.7
Flammable or explosive	NO	NO	(YES)	NO
Toxic	NO	NO	YES	NO

* prEN 378-1 (2003)

These solutions are:

- more expensive,
- consume at least the same amount of energy,
- operate with very high pressures (which significantly increase operation risks).

It will be difficult to run transcritical CO₂ installations in safe conditions in Portugal, since the critical temperature of CO₂ is 31.1 °C and Portuguese summer temperatures are frequently higher than that. Above this critical temperature the physical properties of CO₂ change drastically, with risk of explosion and/or equipment breakdown.

NATURAL REFRIGERANTS: ALTERNATIVES AND CHALLENGES

- Southern countries, such as Portugal (with summer temperatures that easily rise above 30°C), all new solutions must be carefully tested before being widely implemented.

Some companies have been testing R290 in new stores in Portugal. However, this solution:

- It is limited to some refrigeration equipments, due to its flammability;
- It is only acceptable for very small charges of gas;
- CO₂ transcritical installations are far more expensive in terms of investment, than the traditional installations (R134A).

The use of transcritical CO₂ refrigeration plants must take into account the characteristics of the fluid itself, particularly regarding very high pressures.

NATURAL REFRIGERANTS: CONCLUSIONS

- **Portugal is committed to working towards minimising greenhouse gas emissions** and using fully sustainable alternatives. **However, natural refrigerant applications must be safe, reliable, efficient and acceptable** in terms of financial investment.
- Adequate training and knowledge amongst contractors operating in different countries, particularly in the South of Europe, should also be guaranteed.
- Therefore, **it is essential to develop know-how and technical solutions** and to pre-test these solutions before large scale implementation.
- The retrofit must be viewed only as a last resource, because **it is a transitional solution**. If the future perspective is based on natural fluids, the retrofit cannot be the solution. **The use of natural fluids should be restricted to areas where the risks are reduced**, such as low demographic areas, due to security constraints.



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