

Meeting the Challenges of the EU HFC Phase-Down

EPEE Gapometer Project
– Key Messages



November 2017

Background

The EU F-Gas Regulation creates massive cuts in the CO₂ equivalent amount of HFC refrigerants that can be placed on the EU market. This reduction scheme is regulated by a quota system. The first big cut in HFC quota is in 2018. The EPEE Gasmeter Project provides important insights into the actions required to meet the challenging HFC phase-down targets. A Roadmap was developed in 2015 to highlight how these targets could be achieved. Market monitoring is being carried out to identify whether the necessary actions are being undertaken quickly enough for the targets to be met.

The scale of the challenge

The cut in HFC quota in 2018 will be 37% of the baseline amount (the baseline represents historic HFC consumption in the EU). Taking pre-charged imports into account, the actual cut in 2018 will be 44%. In 2021 there will be a further big cut – an overall reduction of 60%. These cuts are measured in tonnes CO₂ equivalent, to encourage: (i) the use of refrigerants with a lower GWP (global warming potential), (ii) the reduction of the amount of virgin HFCs placed on the market and (iii) the recovery and reclaim of HFCs.

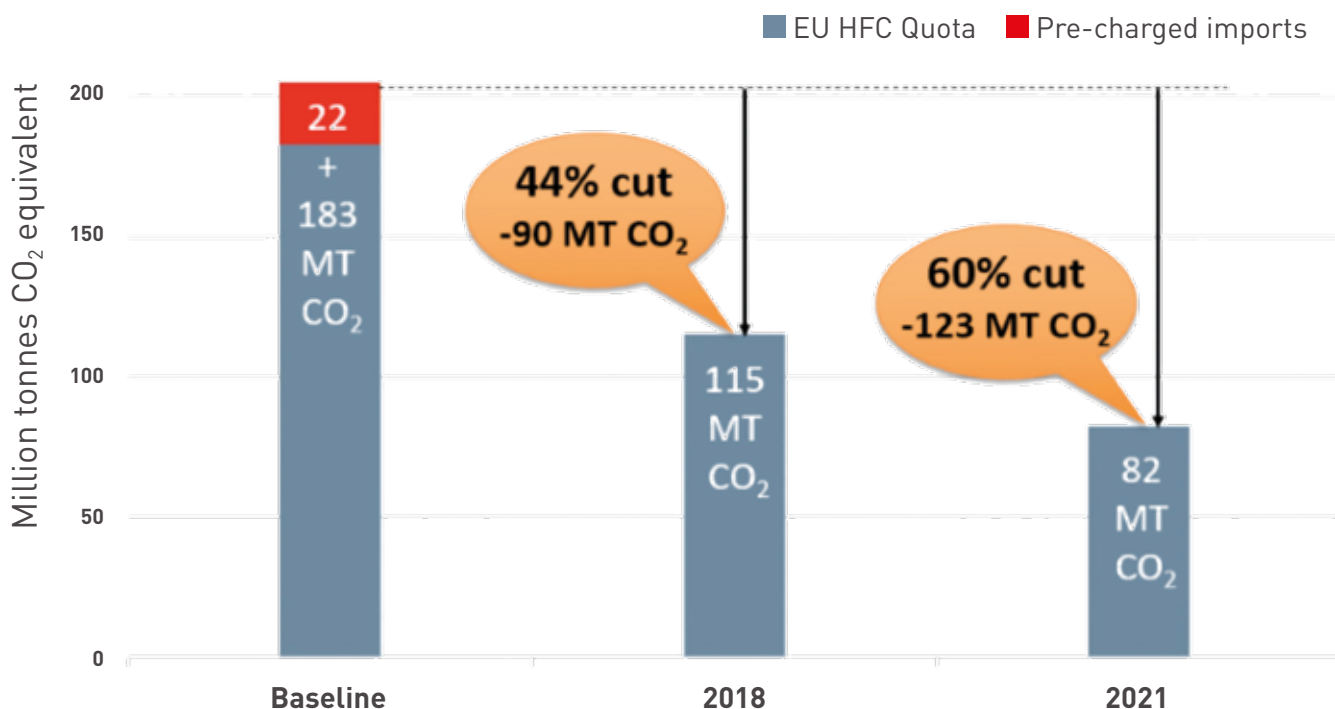
Key risks for end-users

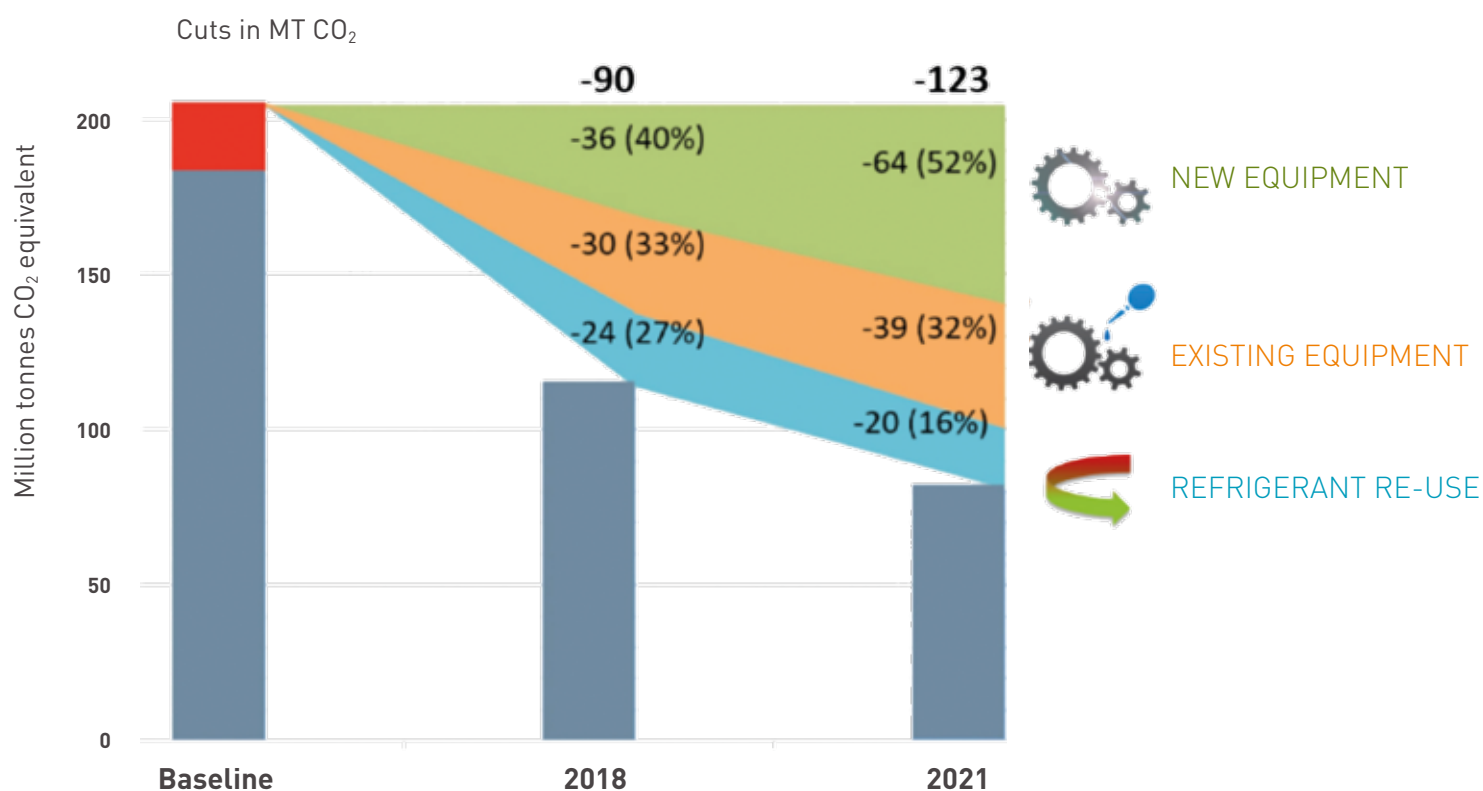
The severe cut of HFC quota will lead to significant price increases for HFC refrigerants, especially those with a very high GWP, such as R-404A and R-507. An important consideration is that the availability of these very high GWP refrigerants could become very limited. This situation will occur if stakeholders do not take sufficient action to reduce HFC demand.

How the challenge can be met:

The EPEE Gapometer Roadmap shows that it will be possible to meet the HFC phase-down targets, but only if a wide range of stakeholders take appropriate actions to reduce HFC demand as a matter of urgency. The Roadmap shows the relative size of the required actions by considering a number of “core actions” that must be undertaken. The core actions include four crucial measures:

- Use of lower GWP refrigerants in new equipment
- Reduction of leakage from existing equipment
- Retrofit of high GWP refrigerants in certain types of existing equipment
- Recovery and reclaim of waste refrigerant





The required actions are sector specific:

The EPEE Roadmap clearly shows that the phase-down actions vary between different parts of the market. In some market sectors, the emphasis will be to ensure that all new equipment is using lower GWP refrigerants than the “traditional” HFCs. In other market sectors, there also needs to be significant action related to existing equipment, especially leak prevention and refrigerant retrofit.

Energy efficiency, safety and cost are vital considerations:

A switch to a lower GWP alternative must not compromise energy efficiency or safety and should not incur excessive cost.

What is the outlook for 2018-2021?

The recent market analysis carried out by EPEE shows some encouraging progress in certain market sectors and in some geographic regions.

However, the research shows that across the whole EU there are significant gaps between the Roadmap requirements and the level of overall activity.

Unless there is a significant increase in the uptake of the core actions in the short-term, it is predicted that there could be a severe shortage of some HFC refrigerants in 2018.

Key Messages

NEW EQUIPMENT



- **Lower GWP refrigerants are already available for most RAC applications**
 - BUT uptake of lower GWP options is slower than required
- **End users must be strongly encouraged to avoid using high GWP “traditional” HFCs**
- **OEMs / equipment suppliers must make lower GWP options available**
- **Some lower GWP options involve flammable refrigerants**
 - Training, the development and use of safety standards and the update of national building codes are urgent priorities
- **Advisors play an important role and must understand the lower GWP options**
 - Some advisors, such as building service consultants and refrigeration contractors, are not yet fully aware of the need for lower GWP refrigerants or alternative design configurations

EXISTING EQUIPMENT



- **Leakage reduction is important, especially in larger systems**
 - Supermarkets are a key sector – historically they had high leak rates
 - There is good evidence of progress by “best-practice” supermarkets, reducing leaks from over 20% per year to well under 10%
 - BUT there is a lack of progress in some supermarket companies and Member States
- **Retrofit of R-404A systems is a crucial contributor to phase-down targets**
 - Supermarkets have embraced this opportunity in some EU countries
 - BUT greater adoption of retrofits across the EU is urgent to meet 2018 targets
 - R-404A (GWP 3922) can often be replaced by refrigerants with GWP below 1500
 - Maximising recovery and reclaim of R-404A
- **Industrial users of HFC systems must also consider leakage and retrofits**
 - BUT industrial users are well behind supermarket sector in relation to these issues

REFRIGERANT RECLAIM



- **Reclaim of refrigerant makes an important contribution to HFC phase-down**
 - Recycled or reclaimed HFCs are not accounted for in the phase-down quotas
 - The EPEE Roadmap shows they can provide over 25% of the required cut in 2018
- **Drivers for recovery and reclaim will grow quickly**
 - Historically there was relatively little HFC reclaim as virgin HFCs were low cost
 - Higher refrigerant prices and shortages of high GWP gases will encourage reclaim
- **RAC contractors and end users need to maximise refrigerant recovery**
 - At equipment end-of-life and when R-404A equipment is being retrofitted
 - This is a legal requirement, BUT some contractors do not comply with current rules
- **The gas supply chain needs to provide supporting infrastructure**
 - By providing: (a) easy access to recovery cylinders,
 - (b) easier transport of “waste gas” between countries and
 - (c) facilities for reclaim of both unmixed and mixed batches of refrigerant
 - There is good infrastructure in a few Member States, but significant work is needed in 2017 and 2018 to maximise refrigerant reclaim

Retail Refrigeration

KEY INFLUENCERS



→ **Large retail chains:** in-house experts working at head office level. It is important that the in-house experts have a clear strategy to address each of the core actions described below.

→ **Small retailers:** OEMs, suppliers and installation / maintenance contractors. Advisors from suppliers and contractors play a key role helping small retailers understand the F Gas Regulation. It is important that they explain the relevant core actions to retailers.

NEW EQUIPMENT



→ Avoid R-404A and R-507A in all new refrigeration equipment, with immediate effect.

→ Use ultra-low GWP options (such as CO₂, hydrocarbons and HFOs) where possible, taking into account safety, energy efficiency and costs. These are already available and cost effective for large central systems and for small stand-alone systems. Cost effectiveness for medium sized systems is rapidly improving. Also consider alternative design configurations (e.g. indirect systems or stand-alone systems).

LEAK REDUCTION



- Ensure minimisation of leakage from existing refrigeration equipment.
- Central multi-pack supermarket refrigeration systems have historically high leakage rates. Leak reduction is particularly important in the retail sector.
- A well-managed leak reduction initiative can reduce leak rates by well over 50%.
- Maintenance contractors must be incentivised to address the leakage issue. Regular reporting of refrigerant use is important to monitor improvements. Individual systems that leak particularly badly need extra attention and investment.

RETROFIT OF EXISTING R-404A SYSTEMS



- Most supermarket companies have a large 'bank' of R-404A in existing equipment.
- Obtaining R-404A to maintain these systems will become nearly impossible from 2018.
- Using virgin R-404A for servicing systems is **banned** from 2020 (systems > 10kg).
- Retrofit of R-404A systems is an important risk mitigation measure for supermarkets. It will make a significant contribution to EU HFC phase-down targets. Waiting for the 2020 service ban is not appropriate – there is too much risk of R-404A shortage in 2018.
- Various non-flammable refrigerants suited to retrofit of R-404A are available.
- Energy efficiency improvements of > 5% are reported by several companies that have completed retrofits – this provides a positive financial driver for retrofits.
- The value of recovered high GWP refrigerant can be an additional incentive for the end user.

USE OF RECYCLED AND RECLAIMED REFRIGERANT



- Recycled and reclaimed refrigerants are not included in the HFC phase-down quotas and can provide an important source of refrigerant supply at times when HFCs are in short supply.
- Recovery of 'waste' refrigerant (at end-of-life or during a refrigerant retrofit) is a legal requirement under the EU F-Gas Regulation. Retail sector users should ensure compliance with this requirement and should encourage their contractors to maximise gas recovery.
- Historically most recovered gas was incinerated. This is no longer the best option. All recovered gas should be either recycled or sent for reclaim. Different refrigerants should not be mixed with each other in recovery cylinders. Supermarket companies can limit the risks of high refrigerant prices by a carefully coordinated "refrigerant management programme" based on the use of recycled or reclaimed refrigerant from equipment reaching end-of-life and from retrofits of existing systems. The potential value of the recovered high GWP refrigerant can be a significant incentive for the end-user.

Building Air-Conditioning

KEY INFLUENCERS



→ **Large buildings:** building services consultants. Most air-conditioning systems for large buildings are specified by design consultants. Many are still specifying “traditional” HFCs, ignoring the lower GWP options that are becoming available. Building designers need to be encouraged to specify lower GWP solutions.

→ **Small buildings:** OEMs, suppliers and installation / maintenance contractors. Advisors from suppliers and contractors play a key role helping small building owners understand the F-Gas Regulation. It is important that they explain the relevant core actions to users.

NEW AC EQUIPMENT: WATER CHILLERS



→ For medium to large size water chillers, R-134a is today the leading refrigerant in Europe. Various ultra-low GWP refrigerants are becoming available, for example R-1234ze/yl and R-516A (safety class A2L) for medium pressure chillers and R-1233zd (safety class A1) or R-514A (safety class B1) for low pressure chillers. Propane (R-290) and ammonia (R 717) can also be considered for higher pressure chillers but may have application limitations due to safety constraints (propane: higher flammability, class A3; ammonia: higher toxicity, class B2L). Non-flammable alternatives are available with a moderate GWP (around 600), including R-513A and R-450A. For smaller chillers, R-410A is the leading fluid. Potential alternatives with lower GWP (in range 100-750) are being proposed, like the HFC R-32 or the blends R-452B and R-454B. All these alternatives to R-410A are mildly flammable (class A2L). Despite the rapidly increasing availability of ultra-low GWP options, their uptake is still slow. OEMs, equipment suppliers and designers must be encouraged to offer lower GWP options while continuing to take into account safety and energy efficiency. Given the long life of water chillers, end users must be encouraged to avoid high GWP refrigerants in new chillers.

LEAK REDUCTION



→ Ensure minimisation of leakage from existing air-conditioning equipment. Most air-conditioning equipment have low levels of leakage. Large installations should be regularly checked for leakage and records kept of the quantities of refrigerant used for top up of leaks. Any large leaks are required to be repaired as soon as possible.

RETROFIT OF EXISTING AC



→ Retrofit of existing air-conditioning equipment to lower GWP gases is not yet being undertaken, but certain non-flammable blends (e.g. R-450A or R-513A) can be considered for retrofit of R-134a systems.

NEW AC EQUIPMENT: DX SYSTEMS



→ **Small split systems:** Until recently most split systems have used R-410A (GWP 2088). There is no ultra-low GWP option currently available in the EU for split air-conditioning. Moderate GWP options such as R-32 (GWP 675) and certain HFO/HFC blends are now available and should be used where possible. These new moderate GWP options have lower flammability (safety class A2L). This could limit application in certain circumstances.

→ **Larger DX systems including VRF and packaged roof-top units:** Currently the main option for large VRF systems is R-410A. Because of flammability constraints in large systems lower GWP alternatives are not currently available. Product developments are underway and VRF systems using A2L refrigerants such as HFC-32 or HFC/HFO blends may be introduced in the future. For packaged roof-top units, A2L refrigerants such as R-32, R-452B and R-454B can be considered.

USE OF RECYCLED OR RECLAIMED REFRIGERANT



→ Recycled or reclaimed refrigerants are not included in the phase-down quotas and can provide an important source of refrigerant supply at times when HFCs are in short supply.

→ Recovery of 'waste' refrigerant at end-of-life is a legal requirement under the EU F-Gas Regulation. Building air-conditioning end users should ensure compliance with this requirement and should encourage their contractors to maximise gas recovery.

→ Historically most recovered gas was incinerated. This is no longer the best option. All recovered gas should be either recycled or sent for reclaim. Different refrigerants should not be mixed with each other in recovery cylinders.

Industrial Refrigeration

KEY INFLUENCERS



→ **Large factories:** in-house experts working at head office level. It is important that the in-house experts have a clear strategy to address each of the core actions described below.

→ **Small factories:** OEMs, suppliers and installation / maintenance contractors. Advisors from suppliers and contractors play an important role helping small industrial refrigeration users understand the F-Gas Regulation. It is important that they explain the relevant core actions to users.

NEW EQUIPMENT



→ Avoid R-404A and R-507A in all new refrigeration equipment.

→ **Large flooded or DX systems:** Use ultra-low GWP options (such as ammonia, CO₂, hydrocarbons and HFOs) where possible. Ammonia systems are widely used in many industrial applications. CO₂ is growing in popularity, especially for the low stage of cascades, in combination with other solutions for the high stage (such as ammonia).

→ **Industrial chillers:** Ammonia is often suitable. Ultra-low GWP HFOs such as R-1234ze/ yf, R-1233zd and R-516A are becoming available.

→ **Smaller DX systems:** To avoid R-404A or R-507A, various non-flammable medium GWP options are available (e.g. R-448A, R-449A, R-449B, R-407A, R-407F, R-407H, R-452A). New HFO/HFC blends with a small level of flammability (safety category A2L) are becoming available and may be suitable in many industrial applications.

LEAK REDUCTION



→ Ensure minimisation of leakage from existing refrigeration equipment. Industrial refrigeration systems have historically high leakage rates. A well-managed leak reduction initiative can reduce leak rates by well over 50%.

→ Maintenance contractors must be incentivised to address the leakage issue. Regular reporting of refrigerant use is important to monitor improvements. Systems that leak particularly badly need extra attention and investment.

RETROFIT OF EXISTING R-404A SYSTEMS



→ Many existing industrial systems use R-404A. Obtaining R-404A to maintain these systems will become nearly impossible from 2018.

→ Using virgin R-404A for servicing systems is **banned** from 2020 (the ban applies to any R-404A system containing > 10kg of refrigerant). The service ban also applies to other refrigerants with a GWP above 2500 e.g. R-507A and R-434A.

→ Retrofit of R-404A systems is an important consideration for industrial refrigeration users. Waiting for the 2020 service ban is not appropriate – there is too much risk of R-404A shortages in 2018.

→ Various non-flammable ‘drop-in’ replacements for R-404A are available for retrofit of direct expansion systems. Energy efficiency improvements of > 5% are reported by several companies that have completed retrofits – this provides a positive financial driver for retrofits. Retrofit of large flooded systems is not usually recommended.

USE OF RECYCLED OR RECLAIMED REFRIGERANT



→ Recycled or reclaimed refrigerants are not included in the phase-down quotas and can provide an important source of refrigerant supply at times when HFCs are in short supply.

→ Recovery of ‘waste’ refrigerant (at end-of-life or a refrigerant retrofit) is a legal requirement under the EU F-Gas Regulation. Industrial refrigeration users should ensure compliance with this requirement and should encourage contractors to maximise gas recovery.

→ Historically most recovered gas was incinerated. This is no longer the best option. All recovered gas should be either recycled or sent for reclaim. Different refrigerants should not be mixed with each other in recovery cylinders. Industrial companies can limit the risks of high refrigerant prices by a carefully coordinated “refrigerant management programme” based on the use of reclaimed refrigerant from equipment reaching end-of-life and from retrofits of existing systems.

RAC Installation and Maintenance Contractors

ROLE AS A KEY INFLUENCER



→ RAC contractors play a very important role in advising their clients about the impact of the EU F-Gas Regulation. It is essential that contractors keep up-to-date with the latest technical developments so that they can provide the best advice about the core actions required to ensure that HFC phase-down targets are met.

NEW EQUIPMENT



→ Contractors should encourage their customers to use lower GWP options where available. During the life of equipment purchased in 2017 or 2018 there will be a significant reduction of HFC quota (a 60% cut by 2021, rising to a cut of nearly 80% by 2027). It makes commercial sense to change to alternatives in new equipment where possible.

→ There is a rapid rate of development of new RAC products using lower GWP refrigerants. RAC contractors need to ensure they are recommending the optimum refrigerant and system design configuration.

→ Avoid using R-404A and R-507A in all new refrigeration equipment, with immediate effect.

→ Ultra-low GWP refrigerants are available in many RAC sectors including retail refrigeration, industrial refrigeration and water chillers.

→ Moderate GWP refrigerants should be considered in some markets e.g. R-32 in split air-conditioning systems.

LEAK REDUCTION



→ Contractors should ensure minimisation of leakage from existing refrigeration equipment that they are maintaining. This is especially important in larger distributed systems such as supermarket central systems and industrial systems. A well-managed leak reduction initiative can reduce leak rates by well over 50%.

→ Maintenance contractors should encourage customers to invest in leak prevention. Systems that leak particularly badly need extra attention and investment. There is a legal requirement to regularly test systems for leakage (except very small systems) and a legal requirement to repair any leaks that are identified. Both end users and their maintenance contractors could be prosecuted if they do not comply with these rules.

RETROFIT OF EXISTING R-404A SYSTEMS



→ A refrigerant retrofit should be considered for existing refrigeration systems using R-404A. Obtaining R-404A to maintain these systems will become nearly impossible from 2018. Using virgin R-404A for servicing systems is **banned** from 2020 (systems > 10kg).

→ Retrofit of R-404A systems is an important risk mitigation measure for supermarkets and industrial refrigeration users. Waiting for the 2020 service ban is not appropriate – there is too much risk of R-404A shortage in 2018.

→ Various non-flammable 'drop-in' replacements for R-404A are available for retrofit of direct expansion systems. Energy efficiency improvements of > 5% are reported by several companies that have completed retrofits – this provides a positive financial driver for retrofits. Retrofit of large flooded systems is not usually recommended.

USE OF RECYCLED OR CLAIMED REFRIGERANT



→ Recycled or reclaimed refrigerants are not included in the phase-down quotas and can provide an important source of refrigerant supply at times when HFCs are in short supply.

→ Recovery of 'waste' refrigerant (at end-of-life or a refrigerant retrofit) is a legal requirement under the EU F-Gas Regulation. RAC contractors should ensure compliance with this requirement and maximise gas recovery.

→ Historically most recovered gas was incinerated. This is no longer the best option. All recovered gas should be either recycled or sent for reclaim. Different refrigerants should not be mixed with each other in recovery cylinders.

Member State Governments

STAKEHOLDER ENGAGEMENT



→ Officials responsible for implementation of the EU F-Gas Regulation should provide support and information to stakeholders, to ensure they are aware of key aspects of the Regulation and the potential risks of a shortage of HFC refrigerants in 2018. Key stakeholders include:

- Major end users, including supermarkets and industrial companies
- RAC equipment manufacturers and importers
- Advisors such as design consultants and building service engineers
- RAC installation and maintenance contractors

→ Government officials should take urgent action to remove unnecessary restrictions in building codes that currently prevent alternatives to be used, by updating their building codes and aligning them with the EU product safety legislation (low voltage directive, machinery directive).

NEW EQUIPMENT



→ End users must be encouraged to use lower GWP refrigerants where available and possible. During the life of equipment purchased in 2017 or 2018 there will be a significant reduction of HFC quota (a 60% cut by 2021, rising to a cut of nearly 80% by 2027). It makes commercial sense for end users to stop using high GWP HFCs in new equipment where possible.

→ Officials should take urgent actions to align national and local building codes with EU refrigeration safety standards and product legislation to remove market barriers. Regular information updates will help stakeholders understand the availability of lower GWP refrigerants. Such information needs to be customised for different types of stakeholders.

LEAK REDUCTION



→ End users and maintenance contractors must be encouraged to minimise leakage from existing refrigeration equipment. This is especially important in larger distributed systems such as supermarket central systems and industrial systems. A well-managed leak reduction initiative can reduce leak rates by well over 50%.

→ End users and contractors should be reminded that it is a legal requirement to regularly test systems for leakage (except very small systems) and to repair any leaks that are identified. Government officials should consider policy initiatives that will incentivise compliance with these aspects of the F-Gas Regulation.

RETROFIT OF EXISTING R-404A SYSTEMS



→ End users must be encouraged to consider refrigerant retrofits for any large refrigeration systems using R-404A. Obtaining R-404A to maintain these systems will become nearly impossible from 2018. Using virgin R-404A for servicing systems is banned from 2020 (systems > 10kg).

→ Retrofit of R-404A systems is an important risk mitigation measure, particularly for supermarkets industrial refrigeration users. Waiting for the 2020 service ban is not appropriate – there is too much risk of R-404A shortage in 2018.

→ Various non-flammable refrigerants suited to retrofit of R-404A are available. Energy efficiency improvements of > 5% are reported by several companies that have completed retrofits – this provides a positive financial driver for retrofits. Retrofit of large flooded systems is not usually recommended.

USE OF RECYCLED AND CLAIMED REFRIGERANT



→ Recycled and reclaimed refrigerants are not included in the phase-down quotas and can provide an important source of refrigerant supply at times when HFCs are in short supply.

→ Recovery of 'waste' refrigerant (at end-of-life or a refrigerant retrofit) is a legal requirement under the EU F-Gas Regulation. Policy measures should be considered to ensure that end-users and RAC contractors comply with this requirement and maximise gas recovery.

→ Officials need to review the availability of refrigerant recycling and reclaim infrastructure and help ensure that reprocessing options are available to all end users in each Member State. They should also facilitate cross border shipments of waste to allow for recycling or reclaiming activities in other regions.



THE VOICE OF THE REFRIGERATION, AIR-CONDITIONING AND HEAT-PUMP INDUSTRY IN EUROPE

About EPEE

The European Partnership for Energy and the Environment (EPEE) represents the interests of the refrigeration, air-conditioning and heat pump industry in Europe. Founded in the year 2000, EPEE's membership is composed of 47 member companies, national and international associations from Europe, the USA and Asia, employing more than 200,000 people in Europe and realising a turnover of over 30 billion Euro.

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