



Chilling* Facts V:

RETAILERS ON THE CUSP OF A
GLOBAL COOLING REVOLUTION



ABOUT EIA

EIA is a small charity founded in 1984 to fight environmental crime. We have developed innovative and effective investigative methods for defending the environment and seek lasting solutions to the problems we uncover. From stopping the live transport of wild birds and getting the elephant ivory trade ban in place in the late 1990s to shutting down one of the biggest illegal timber trade routes, EIA's work has changed the face of the world for the better.

We also play a unique and essential role in combating climate change. EIA is the most active NGO calling for an HFC phase-out, campaigning at national, European and global levels.

ACKNOWLEDGEMENTS

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BACKGROUND

Since its launch in 2009, EIA's annual *Chilling Facts* report has documented a revolution in retailers' approach to refrigeration.

However, while the adoption of climate-friendly refrigeration by some parts of the industry is impressive, there is still quite a way to go before HFC-free refrigeration is a feature of every supermarket. Mindful that progress is not confined to the UK, we have continued to expand our outreach year-on-year, with 21 retailers from across Europe responding to this year's survey.

Global HFC emissions are rising at an alarming rate of 10-15 per cent a year.¹ and are predicted to reach between 5.5-8.8 GtCO₂e (gigatonnes of carbon dioxide equivalent) by 2050 under a business-as-usual scenario.² Commercial refrigeration, accounting for about one-third of all HFC emissions, represents a large portion of that problem.³

In the current economic climate it is understandable that phasing out a third generation of fluorinated greenhouse gases is a challenge. But history has shown that the industries involved have a remarkable capacity to adapt to change and to reap enormous energy gains in shifting to newer technologies, as was seen with the phase-out of chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs). We must accept that action now, which may involve extra upfront costs and manageable disruption in the short term, is a small price to pay when compared to the increasingly unmanageable impacts and long-term financial implications of man-made climate change.

In this its fifth year, we hope EIA's *Chilling Facts* survey will continue to play a vital role in the refrigeration debate by showcasing real-life examples of climate-friendly refrigeration used by supermarkets across the globe.

WHAT ARE HFCs?

Hydrofluorocarbons (HFCs) are man-made fluorinated gases (F-gases) developed and commercialised to replace CFCs, HCFCs and other chemicals that deplete the ozone layer. Unlike CFCs and HCFCs, HFCs do not destroy ozone; however, they are powerful greenhouse gases (GHGs), with global warming potentials (GWP) hundreds or thousands of times more powerful than carbon dioxide (CO₂). HFCs are primarily used in refrigeration, air conditioning, foam blowing, aerosols, fire protection and solvents.

THE REPORT

This year's report is bigger than ever, with participation from 21 retailers. In 2013, the wave of climate-friendly refrigeration is continuing to spread across Europe, and in its wake impressive energy efficiency improvements are being made.

While EIA applauds the efforts made by some retailers, the gap between those taking their environmental responsibilities seriously and those who are not is growing, highlighting an urgent need to legislate against the use of HFCs in this sector. Well-crafted legislation would support progressive retailers and stimulate demand for alternative technologies, which would in turn lead to a significant reduction in capital costs.

The European Union is in the process of rewriting the rules on F-gases and is considering a ban on the use of HFCs in

new stationary refrigeration equipment from 2020. Based on the detailed information we have gathered during the past five years and on-going dialogue with many retailers, we believe such a ban is technically feasible and can be implemented safely and efficiently, even in warmer climates, as this year's report shows.

While we recognise the various practical challenges associated with moving away from HFCs, the biggest challenge lies in changing prevailing mind-sets.

KEY FINDINGS FOR 2012

Supermarkets across the EU are at vastly different stages in improving the environmental credentials of their refrigerated food supply systems.

Supermarkets across the EU are at vastly different stages in improving the environmental credentials of their refrigerated food supply systems. Swiss supermarkets are performing particularly well, especially in terms of rolling out natural refrigeration systems. Others, such as Royal Ahold in The Netherlands, have impressed us with their use of doors on about 80 per cent of store cooling. Many British retailers are still leading the way in both developing and rolling out HFC-free technologies, despite limited Governmental support.

Among the supermarkets contacted by EIA [*], a core group is making particularly impressive efforts to reduce the impact of refrigeration systems, including Coop Schweiz, Coop UK, Marks & Spencer, Migros, Royal Ahold, Aldi Süd, Tesco and Waitrose. Each of these has been highlighted as an 'EIA Green Cooling Leader' due to the outstanding efforts they are making. As ever, they will need to maintain this momentum into the future, and the following comments on each supermarket also highlight specific areas for improvement.

KEY FINDINGS FOR 2012: UK

COOP UK

GOOD:

- Wide-scale rollout of HFC-free cooling with hydrocarbon freezer and fridge integrals in over 2,400 stores, equating to almost 20% of total refrigeration used.
- From 2015 all new installations will be HFC-free, with full conversion out of HFCs by 2030.
- Developing hydrocarbon-based secondary refrigeration which is expected to be their primary future technology.

BAD:

- Have fallen behind on rollout of chiller doors, having completed just 120 whilst 200 were planned for 2012.

EIA GREEN COOLING LEADER



ICELAND

GOOD:

- Continuing to increase energy efficiency of stores. Utilising free cooling in stores.
- Trialling hydrocarbon chilled water refrigeration system.
- 85% of all cabinets fitted with doors and lids

BAD:

- Rollout of hydrocarbon integrals appears to have stalled due to energy consumption concerns.
- EIA fails to understand this delay, given other retailers' successes with hydrocarbon integrals.

MUSGRAVE

('RETAIL & WHOLESALE', 'SUPERQUINN' AND 'BUDGENS')

GOOD:

- Uses HFC-free frozen food integral units in 20% of the 'Retail and Wholesale' stores and some hydrocarbon systems in use in Budgens stores.
- 'Retail and Wholesale' stores have been trialling use of natural refrigerants in integral chilled cabinets and Budgens has trialled a combined hydrocarbon-air hybrid system.

BAD:

- HFCs used in over 95% of point-of-sale systems and 100% of other systems.
- Only around 10% of distribution centres use ammonia, the rest rely on HFCs.
- Despite the use of hydrocarbon frozen food cabinets in the 'Retail and Wholesale' stores, Superquinn is still installing HFC frozen food cabinets.
- No stringent company policy on an acceptable GWP limit or plan to stop using HFCs in the future.

LIDL

GOOD:

- Have increased number of HFC-free freezer cabinets by over 20%, bringing the total number to around 9,000.
- Leakage figure for new plug-in chillers <1%.
- Due to building design, less than 10% of stores use air conditioning.

BAD:

- Backtracked on last year's commitment to switch to natural refrigerants, instead deciding to rollout HFC-134a plug-in chillers.
- No movement on fitting doors on fridges, citing the negative influence on turnover.

MARKS & SPENCER

GOOD:

- 76 stores running on alternatives (mostly CO₂-HFC hybrids)
- Natural refrigerant volume used on shop floors and back-of-house quadrupling to almost 20% of total refrigerants used.
- Aim to have entire estate converted out of HFCs by 2030.
- 47% drop in HFC emissions on last year, mainly due to switch from HFC-404A to HFC-407a.
- Re-trialling CO₂ transcritical systems.

BAD:

- Discouraging that they have retreated from their 2011 commitment to go HFC-free.
- Lack of progress on adopting doors on fridges, stating that they adversely affect sales.

EIA GREEN COOLING LEADER

TESCO

GOOD:

- Has 149 HFC-free systems in stores across the globe, 84 of which are non-UK including 5 in China and 6 in South Korea.
- In the UK, all new larger format stores and about one-third of smaller Express stores will be fitted with natural refrigeration systems.
- Doors on fridges are standard for all smaller stores. Almost all stores in Turkey, Hungary and Poland have doors on fridges.

BAD:

- Could work harder to ensure more stores are using natural refrigeration systems: only 14 UK stores added in the past year (representing <1% total UK stores).

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WAITROSE

GOOD:

- Have been HFC-free in new installations since 2010, reaching 98 stores this year.
- Aim to have entire estate converted out of HFCs by 2021.
- Simple, cost-effective systems have yielded reduced system "down-time" and energy savings of about 20%.

BAD:

- Still has one distribution centre running on HFC-404A.
- No progress on converting transport systems away from HFCs.

EIA GREEN COOLING LEADER

* EIA contacted a large number of supermarkets for this report, receiving replies from 21 in total. We know there are many supermarkets throughout the EU which do not feature in this report but which are nonetheless making great improvements to their refrigeration systems. If we did not contact you but you would like to be included in next year's survey, please get in touch and share your stories of refrigeration improvement with us. The following supermarkets were all contacted and either failed to submit a survey or did not respond. We will be contacting all of them again next year and encourage them to submit responses so that we can form a more accurate picture of the pace of change across Europe. Supermarkets which failed to respond to our 2013 survey include: Asda (UK), Booths (UK), Cactus (Luxembourg), CBA (Hungary), Colruyt (Belgium), Conad (Italy), Condis (Spain), Coop (Italy), Dansk Supermarked (Denmark), Dia Group (Spain), Dunnes Stores (Ireland), Edeka (Germany), Eroski (Spain), Fantastico (Bulgaria), FDB (Denmark), FENACOOOP (Portugal), Hagkaup (Iceland), Iki (Lithuania), Kesko Food (Finland), Konzum (Croatia), Lidl (Germany), maltasupermarket.com (Malta), Maxima (Lithuania), Mercadona (Spain), Morrisons (UK), Rewe (Germany), Sainsbury's (UK), Scotts Supermarket (Malta), Selver (Estonia), SOK (Finland), Sonae (Portugal), Spar (Denmark), Spar (Switzerland) and Top! (Latvia).

KEY FINDINGS FOR 2012: REST OF EUROPE

ALDI SÜD

GOOD:

- CO₂ is standard refrigerant for all new German stores.
- 151 stores using HFC-free cooling and a further 49 using CO₂/HFC hybrids.
- All 440 Austrian stores are supplied with 100% green electricity.

BAD:

- Has decided against doors on fridges, citing energy efficiency losses.
- Should be rolling out German refrigerant policy across wider European estate, where HFCs constitute over 99% of refrigerants used.

EIA GREEN COOLING LEADER



CARREFOUR

GOOD:

- Number of CO₂/HFC hybrid or HFC-free stores has increased to 70.
- Doors on fridges have been rolled out in more than 40 stores.
- Centralised CO₂ systems have achieved energy gains of 10-20%.

BAD:

- Appears to be delaying transition from CO₂/HFC hybrid to 100% HFC-free systems, with previous plans to roll out HFC-free systems from June 2013 postponed.
- Leaking refrigerants accounts for 42% of its carbon footprint.

COOP NORGE

GOOD:

- CO₂ is standard refrigerant in all new stores.
- 40 stores are using HFC-free technology.
- Doors are installed as standard on refrigeration cabinets.
- Installation of heat recovery systems in new stores.

BAD:

- Incomplete survey, information missing on energy use and leakage data.

COOP SCHWEIZ

GOOD:

- Has been HFC-free in new installations since 2010.
- Aims to have entire estate converted out of HFCs by 2023.
- Has 200 stores running on CO₂ technology.
- HFC-free refrigeration is achieving 30% reduction in energy consumption with additional savings from heat recovery.

BAD:

- Rejected doors on refrigerated food (other than fish), citing high customer footfall and the need for additional air-conditioning to compensate.

EIA GREEN COOLING LEADER



COOP SVERIGE

GOOD:

- All new store refrigeration installations are HFC-free.
- 25 stores are equipped with CO₂ refrigeration systems.
- Plans to be carbon neutral by 2020.

BAD:

- No company policy on an acceptable GWP limit or plan to phase out HFCs completely.

DELHAIZE GROUP

(INCLUDES ALPHA BETA, GREECE AND MEGA IMAGE, ROMANIA)

GOOD:

- 40 stores are using HFC-free technology and additional use of hydrocarbon plug-in freezers in Romania.
- Will begin trials on more climate-friendly air-conditioning systems in Belgium this year.
- Piloting transcritical CO₂ systems in the US.

BAD:

- Does not yet have an official policy to stop using HFCs, despite being part of the Consumer Goods Forum pledge.
- Needs to start HFC-free trials in Alpha Beta stores, Greece.

EL CORTE INGLÉS

GOOD:

- Rolling out doors on fridges; so far 15% of units have doors.
- Two distribution centres are using natural refrigerants.

BAD:

- Without immediate concerted action will fail to meet its Consumer Goods Forum pledge.
- Not even piloting the use of natural refrigerants, while 10 stores are still using HCFCs for cooling.

JERÓNIMO MARTINS

GOOD:

- Has reduced electricity use by over 50% in Polish stores.
- Over 340 stores are equipped with heat recovery systems.
- Most distribution centres are using HFC-free cooling.
- Doors on fridges have been rolled out in 85 stores.

BAD:

- Without immediate concerted action will fail to meet its Consumer Goods Forum pledge.
- Annual refrigerant leakage rates increased by over 20% between 2011 and 2012.
- No intention of moving away from HFCs altogether and no policy on an acceptable GWP limit.

KAUFLAND

GOOD:

- 40 stores using CO₂-HFC hybrid technology and another three pilot stores using 100% CO₂ systems.
- High use of ammonia in distribution centres

BAD:

- HFC-404A still being used as main refrigerant in over 90% of stores.
- Incomplete survey, information missing on energy use and direct emissions.
- No policy to stop using HFCs altogether and no company policy on an acceptable GWP limit.

ICA

GOOD:

- Has been HFC-free in new installations since 2010
- 35+ stores using HFC-free cooling and a further 100+ using CO₂/HFC hybrids.
- Leakage rate just 3.6% when last assessed in 2011
- A quarter of stores have doors on chiller cabinets; this has been standard for all new stores since 2009.

BAD:

- High use of HFC-404A in existing point-of-sale refrigeration systems (80%).
- Similarly, all distribution centres still use HFCs.
- No company policy on an acceptable GWP limit.

MERCATOR

GOOD:

- Plans to introduce a CO₂ hybrid system in a refurbished store this year.
- Ammonia is used in some distribution centres.

BAD:

- Falling behind in preparations necessary to meet its Consumer Goods Forum Pledge.
- Direct emissions from Slovenian stores increased by almost 5% between 2011-12.
- Does not have plans to expand the roll-out of doors on fridges beyond 48 stores despite reduced energy consumption.

MIGROS

GOOD:

- Has been HFC-free in new installations since 2010, reaching 213 stores this year.
- 78 stores use doors on fridges.
- CO₂ and ammonia comprise over 80% of cooling for industrial and distribution centre operations.

BAD:

- Falling short of its own energy consumption targets.

METRO

GOOD:

- Has increased alternative refrigeration systems (both hybrid and HFC-free) from four to nine stores, with a further nine planned in 2013.
- Investigating the use of chiller doors.

BAD:

- Low level of refrigeration systems using natural refrigerants compared to other retailers of a similar size.
- HFCs and HCFCs accounted for 97% of refrigerant refills in 2012.

ROYAL AHOLD

GOOD:

- Has increased the number of CO₂/HFC hybrid to 227 in total, with a further three stores running on HFC-free systems.
- Plans to phase out all HFCs within next 15 years.
- Leakage rates in Dutch stores down to just 6.6%.
- Doors on all frozen cabinets and around 80% of cooling cabinets.

BAD:

- Heavy reliance on HFC hybrids: needs more testing of HFC-free systems.
- While leakage rates in The Netherlands have decreased, rates in other European stores have increased compared with last year's figures, reaching 14%.

EIA GREEN COOLING LEADER



EIA GREEN COOLING LEADER





CHILLING FACTS: THE KEY ISSUES

“ Ahold’s policy is to only use natural refrigerants as of 2015 ... it’s likely that synthetic refrigerants will be phased out steadily in the coming 10-15 years ”

Royal Ahold

1. UPTAKE OF NATURAL REFRIGERANTS

Many retailers are steadily moving away from long-established HFC refrigeration systems and towards those using a group of non-HFC coolants commonly referred to as natural refrigerants. Such installations often use ammonia, CO₂ or hydrocarbons, which have comparatively little or no impact on global warming and zero impact on the ozone layer. For instance, CO₂ gas has a global warming potential (GWP) of just one, compared with a figure of almost 4,000 for HFC-404A, currently the most widely used HFC for commercial refrigeration applications.

Since last year’s report, many supermarkets across the UK and Europe have continued to roll out HFC-free systems while others are using hybrid HFC systems (with both HFCs and natural refrigerants), often as an interim step towards completely phasing out HFCs.

Results from the UK alone have shown a 24 per cent increase on our 2012 report in the number of HFC-free or hybrid technology systems being used in stores, bringing the total number of systems to 428. Across Europe, our survey results

show that the number of hybrid cooling technology systems being used in stores has risen to 589, while over 1000 additional stores are using HFC-free technology. In addition to this, many supermarkets have pledged to install only HFC-free systems from now on in all new and refurbished stores, including Aldi Süd (only in Germany), Coop Norge, Coop Sverige, Coop Schweiz, ICA, Migros, Sainsbury’s, Tesco (only in larger British stores) and Waitrose.

The above figures do not include details of the thousands of stores using plug-and-play hydrocarbon units as their frozen food integrals. It is important to note that while many supermarkets are already using hydrocarbons in their freezer units, they are not yet using non-fluorinated alternatives in their chilled food integrals and many have highlighted a need for further technical developments in this area.

Since last year’s *Chilling Facts* report, Royal Ahold has increased the number of hybrid HFC/CO₂ stores it operates by about 30 per cent, reaching a total of well over 200 stores in The Netherlands and Belgium. This represents over a quarter of its estate. Similarly, Coop Schweiz has increased the number of its stores running on 100 per cent

CO₂ systems by around 30 per cent compared with last year's report, again reaching about 200 stores in total, or a quarter of its entire estate. Coop Schweiz plans to replace all refrigerants in its stores with CO₂ during the next 10 years. Other supermarkets, such as Lidl, are taking more time to transition to HFC-free solutions for all cooling applications. However, even this retailer is moving away from HFCs in its frozen food systems, with half of all freezer units running on hydrocarbons.

Tesco, aside from continuing to roll out natural refrigeration systems, is encouraging best practice in refrigeration systems throughout its supply chain via the Tesco Knowledge Hub, an online community enabling the supermarket's suppliers to share best practice.

Waitrose is making good progress in its ambition to operate totally HFC-free by 2021, with about one-third of its stores running on natural refrigerants to date. Marks & Spencer continues to roll out hybrid systems, increasing the number of stores running on this technology to 76 (up from 42 last year), as well as developing various other systems which use ammonia, hydrocarbons or CO₂. Delhaize Group almost reached its stated target for 2012, which was to roll out a further 15 stores using hybrid technology, reaching a total of 40. METRO is also rolling out some natural refrigerant systems; however, progress is slow given the size of its estate and it is yet to make any progress in countries outside the EU.

Some of the retailers in the report are relying quite heavily on CO₂/HFC hybrids in their transition plans. While it is commendable that supermarkets such as Marks & Spencer are taking an interim step to limit their use of high-GWP HFCs in the immediate term, CO₂/HFC hybrid systems are emphatically not a long-term solution. It is crucial that supermarkets move on swiftly towards 100 per cent HFC-free systems, to avoid being locked in to a dead-end technology. Other supermarkets rolling out HFC hybrids, such as Carrefour and Royal Ahold, need to be careful that their hybrid systems do not cause them to renege on their commitments to go HFC-free in all new equipment from 2015.

In most cases, it surely makes more sense to switch to HFC-free equipment from the start, rather than having to invest in yet another generation of cooling equipment so soon after the last one.

2. LEAKAGE

High leakage rates and rapid global growth of the retail industry make commercial refrigeration one of the biggest sources of HFC demand. In Europe, annual HFC emissions from this sector are expected to be 17.6 MtCO₂e in 2015,⁴ based on full implementation of containment and recovery measures within the current EU F-Gas Regulation (which is not happening). This is equivalent to the annual CO₂ emissions of almost six coal-fired power stations,⁵ or 10.5 million return flights for one person between London and Bangkok.⁶

Table 1 shows annual HFC emissions from the three biggest emitters in this report, all of which rank among the top 10 European retailers (based on annual turnover). Carrefour is by far the biggest emitter, with global annual emissions from leaking HFC refrigerants equivalent to 1.48 MtCO₂e, accounting for 42 per cent of its carbon footprint. Carrefour Group's total emissions equate to almost 0.7 per cent of France's entire annual greenhouse gas emissions.⁷

The staggeringly high impact of HFC emissions from the commercial refrigeration sector is mainly due to the fact that refrigerant gas continues to leak out of systems at unacceptable rates. Analyses of data supplied by retailers shows that, despite containment efforts, **absolute emissions (in CO₂ equivalent terms) from leaking refrigerant gases are still higher than the total emissions associated with energy use from systems.** In short, removing HFCs from a system often has a bigger positive environmental impact than using carbon neutral energy. Clearly, all retailers should be using renewable energy as standard; however, to date only Coop Schweiz, Coop Sverige and Aldi Austria are doing so.

TABLE 1: CHILLING FACTS TOP THREE HFC EMITTERS (FIGURES SHOWN ARE GROUP-WIDE)

RETAILER	ANNUAL HFC EMISSIONS (tCO ₂ e)
CARREFOUR	1,480,000
TESCO	755,660
METRO	644,000

While successive *Chilling Facts* reports identify a move away from HFC-based refrigeration as the overriding objective for retailers, it is obvious that efforts to tackle HFC emissions must also address leakage from systems which have not yet reached end-of-life. Although the F-Gas Regulation has been in force across Europe from 2007, leakage rates in the retail sector remain high.

This year, many retailers stated they were unable to provide leakage rates (calculated as the amount of refrigerant added to refill systems divided by total charge in all systems), with many preferring to focus on direct emissions. Of those with comparable data from last year's survey, most remained stable while a slight overall drop was noted. ICA had the lowest rates from centralised systems with just 3.6 per cent recorded for 2011. Despite a slight drop in leakage rates for its Netherlands-based stores, Royal Ahold's leakage rates for the rest of Europe increased from 12.6 per cent in 2011 to 14.2 per cent during 2012.

What can be done to address leakage?

Being proactive

EIA is impressed by some retailers' efforts to tackle leaking refrigerants in a proactive way. For example, Royal Ahold, Carrefour, Tesco, METRO and Waitrose all use their leakage information to identify the worst performing stores and produce action plans to address leakage in those locations. Relying on leakage detection systems alone is not enough as these are often only triggered by larger leaks and do not show the source of the leak. Retailers should also regularly use technician leak-testing with hand-held detectors which are more effective in finding smaller leaks and pinpointing their source. Waitrose's use of "secret sniffer" service engineers who visit branches in order to locate leaks and assess areas for potential future leaks is a good example of this.

System design

In an effort to reduce leakage, some retailers are paying attention to how a system is designed. For example, Lidl uses very simple store installations with minimal pipework to reduce leakage potential. Swedish retailers and authorities have worked together to facilitate a shift away from direct expansion systems to indirect systems, reflected by ICA's low leakage rates of 3.6 per cent. Others, such as Marks & Spencer, have reduced

average refrigerant charge. Increasing numbers of retailers are using hermetically sealed factory-filled units as these have the advantage of affording much lower leakage rates combined with reduced servicing requirements.

Addressing leakage not only plays an essential role in minimising the impact of existing HFC systems in stores, but it is also essential in any refrigeration system to ensure effective and safe operation.

Banning the use of HFCs with very high GWP

An additional factor contributing to the large impact leaking HFCs have on our climate is that the HFC refrigerant of choice for most retailers using centralised systems is HFC-404A which has a GWP of 3,922. If an average supermarket refrigeration system uses 650kg of refrigerant,⁸ a 10 per cent leak of 65kg would result in CO₂ emissions of 255 tCO₂e, which equates to the average annual carbon footprint of 34 EU citizens.⁹

One 'quick fix' option for reducing the climate impact of emissions from a retailer's existing estate is to replace HFC-404A with a drop-in alternative such as HFC-407F (GWP 1,705) or HFC-407A (GWP 1,990). While these blends still have a significant climate impact, their GWPs are about half that of HFC-404A, so transitioning to these blends in existing equipment can dramatically cut the climate impact of leaking refrigerants in the short term.

Several retailers have recognised the benefits of this temporary step; for example, Tesco is switching to HFC-407F in all of its existing stores which are not being converted to natural refrigerants during the next four years, and is trialling its use in transport refrigeration. Marks & Spencer has now almost completed its programme to replace HFC-404A with HFC-407A. The retailer reports a relatively painless transition, having addressed an initial increase in leaks, and systems are running with 10 per cent energy efficiency improvements. It is likely that these improvements have come from diligent leak testing once the new gas was in the systems. Similarly Spanish retailer Condis is converting 10 stores to HFC-407A, with a view to a wider rollout, following a trial in one store that resulted in a 25 per cent reduction in energy consumption.¹⁰

" Any existing UK stores that are refreshed over the next four years will be refitted with natural refrigeration. All others will be switched to R407F and then replaced with natural refrigeration when they come to the end of their life "

Tesco

3. ENERGY EFFICIENCY

Refrigeration accounts for the lion's share of a supermarket's total electricity consumption, and is estimated to represent about 3-4 per cent of the total sales price of a refrigerated food or drink item.¹¹ Globally, refrigeration systems use 15–20 per cent of the world's electricity.¹² In the current economic climate, it should come as no surprise that companies are more eager than ever to identify opportunities for energy savings. However, our survey has shown mixed results in terms of how effectively individual retailers are addressing this crucial issue.

Doors on fridges

Installing doors on fridges is the single most effective measure by which to cut energy costs associated with commercial refrigeration, offering a substantial reduction in energy consumption for a payback period limited to a few months (a recent study suggests the payback period is about 16 months¹³). In 2007, a report by the Dutch Energy Research Centre¹⁴ (ECN) found that fitting doors on fridges can achieve energy savings of 40-55 per cent, while a 2008 French study¹⁵ concluded that they offered sales area energy savings of 38-50 per cent. Table 3 details potential annual financial savings, due to placing doors on fridges for a range of retailer sizes as modelled by the French study.

Following this French study, a voluntary Code of Conduct was signed in 2012 by the largest French retailers,¹⁶ in partnership with the French Ministry of Ecology, Sustainable Development, Transport and Housing (MEDDTL) and the French Retailers Association (FCD). The agreement stated that doors on fridges should be installed in all new and refurbished stores, a move that should deliver a direct total energy saving of 11TWh by 2020, by which time 75 per cent of their combined estate should be equipped with them. To put that in perspective, 11TWh is enough to power all of Sweden's railways, subways and trams for almost five years.¹⁷

Encouragingly, some retailers have already taken these and similar findings to heart and are making excellent headway with their roll-out programmes. Royal Ahold, for example, has fitted doors on all its frozen cabinets and around 80 per cent of cooling cabinets,

a percentage set to rise with every refurbishment it undertakes. At Coop Norge, doors are also installed as standard on all refrigeration cabinets; similarly, at ICA, all store refit plans have glass doors as standard. Tesco is fitting doors as standard in its smaller stores; on average 86 per cent of its stores in Turkey, Hungary and Poland have doors on fridges and more than 25 per cent of stores in South Korea, Ireland, Czech Republic and Thailand are also having doors fitted. Other retailers are making reasonable progress. Iceland has doors and lids on 85 per cent of its cabinets. Carrefour has installed doors on fridges in more than 40 of its stores and is committed to rolling this out to 75 per cent of its stores by 2020. El Corte Inglés, Coop UK and Delhaize Group are also implementing their own rollout plans. Jerónimo Martins has doors on chillers in a rather modest total of 85 of its 2,538 stores but seems nonetheless committed to this approach.

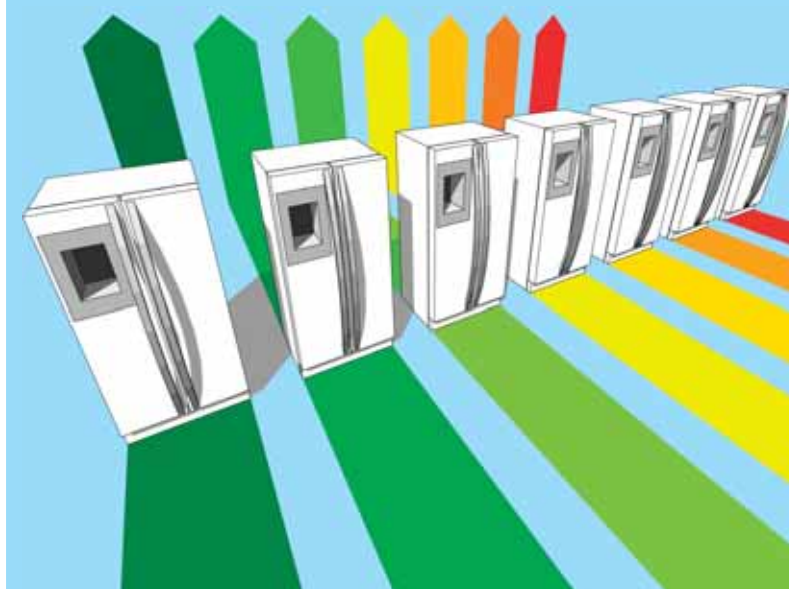
Disappointingly, several retailers have rejected doors outright or are not

“ We are completely in favour of installing doors (on fridges) as this represents an important energy saving measure. In addition, we believe that the use of doors leads consumers to perceive the products as being much fresher and cleaner ”

El Corte Inglés

TABLE 2: POTENTIAL ANNUAL ENERGY AND FINANCIAL SAVINGS RESULTING FROM PLACING DOORS ON FRIDGES IN A SUPERMARKET
Source: Adapted from PERIFEM & ADEME, 2008

Size of Supermarket (m ²)	Annual Saving by Placing Doors on Fridges	
	kWh	€
18,000	4,500,000	300,000
5,500	800,000	60,000
2,500	700,000	50,000



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prepared to commit either way. Some, such as Marks & Spencer and METRO, are still assessing the implications of installing doors on fridges and are therefore no further along than one year ago. Others, such as Aldi Süd, are strongly opposed. Aldi Süd cites “energy efficiency losses” as the reason it has chosen not to go for doors, based on frequent opening of the cabinets by customers. We can only assume this is down to a design flaw in the cabinets which the retailer has tested so far and suggest that greater sharing of information between supermarket chains might help resolve the reservations it and other retailers such as Coop Schweiz, Lidl and Mercator appear to have.

While a voluntary approach is showing promise in France, a regulatory approach is also worth considering. For some time now, the European Commission has been looking at the possibility of making doors on fridges mandatory under the Ecodesign Directive.¹⁸ In the absence of an industry-wide shift, this might well turn out to be the most effective way forward.

System design and refrigerant choice

In addition to the fitting of doors on fridges, an obvious option for achieving greater efficiency lies in system design and the choice of refrigerant. Time and again, retailers are reporting significant energy efficiency gains from swapping out of HFC-based systems in favour of equipment that runs on alternatives. In the case of CO₂, where the historical concern has been energy efficiency, there has been a major focus on system design, allowing supermarkets to at the very least ‘break even’ (from an energy consumption perspective) and often reduce energy use by a significant amount. CO₂ is now the standard refrigerant used in all new supermarkets in Switzerland by law and is also being adopted for all new refrigeration systems by UK retailer Booths, Coop Norge, Aldi Süd’s German operations and Sainsbury’s.

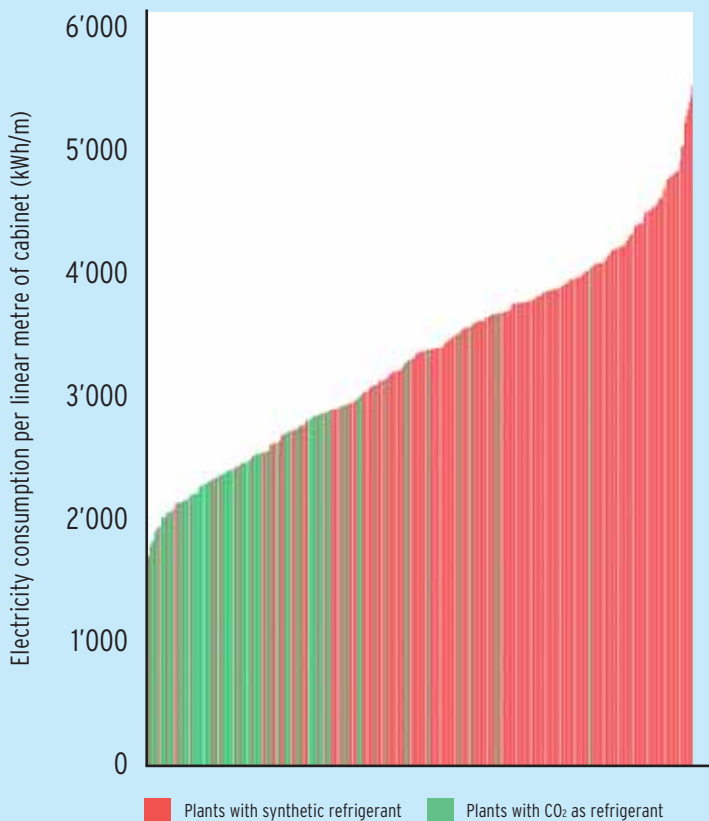
All newly built and refurbished Coop Schweiz stores use CO₂ transcritical systems for cooling and a quarter of its stores are already running on this technology, reducing energy needs by about 30 per cent. It reports no loss in efficiency on warmer days and plans to have all its retail stores equipped with 100 per cent CO₂ by 2023. Around one in six stores of Danish retailer Fakta operate with transcritical CO₂ equipment, with the most recent systems delivering 10 per cent energy savings¹⁹ over HFC alternatives.

Aldi Süd, which is switching to transcritical CO₂ in all its new builds in Germany, has reported that the energy consumption associated with its new systems is lower than that of its systems running on HFCs. Similarly, Delhaize Group reports both its cascade and transcritical CO₂ systems use less energy than installations running on HFC-404A. Carrefour has achieved energy gains of 10-20 per cent using CO₂ transcritical.

In Hungary, Auchan has also achieved energy savings of 35 per cent²⁰ with its hybrid CO₂-ammonia systems compared with previous HFC installations. Waitrose has developed a hydrocarbon water-cooled refrigeration system which uses about 20 per cent less energy compared to its traditional HFC systems. Further benefits of this system, which uses a high level of integral units, include reduced maintenance costs and system downtime. Tesco also finds that

FIGURE 1: ENERGY EFFICIENCY COMPARISON OF HFC REFRIGERANTS VERSUS CO₂ SYSTEMS IN COOP SCHWEIZ STORES, EXHIBITING AN AVERAGE ENERGY SAVING FOR CO₂ SYSTEMS OF ABOUT 30%.

Source: Coop Schweiz



on average, its HFC-free systems in Europe use five per cent less energy than HFC systems.

Energy use of HFC-free systems in warmer climates

Japanese retail giant AEON, which has committed to introduce CO₂ in all its new stores, reports energy savings of between 10-30 per cent and an overall CO₂ reduction of 50 per cent in the stores it has converted to CO₂ since 2009. The retailer notes that its transcritical direct expansion CO₂ systems provide high reliability and high efficiency even in hot and humid climates.²¹ Similarly, Carrefour's transcritical CO₂ store in Istanbul, Turkey, is reporting energy efficiency improvements of about 15 per cent.

Other retailers are using different HFC-free technologies to cope with warmer climates. Hydrocarbons are well suited to hot ambient temperatures and retailer Tesco has begun using water-cooled hydrocarbon systems in one of its Thai stores, resulting in five per cent energy savings. Between 2008-11, German sustainable development agency GIZ-Proklima and South Africa's Environment Ministry assisted South African retailer Pick 'n Pay to install hybrid cascade systems running on CO₂ and ammonia in two of its supermarkets in Cape Town and Johannesburg, which are located in different climate zones (respectively medium and high ambient). The project was driven by a desire to reduce electricity consumption in a country experiencing an energy supply shortage. The two stores were opened in December 2009 (which corresponds to summer in the southern hemisphere) and are now fully operational. One year on from the installation of the new systems, energy consumption data from both stores demonstrated energy savings of 19-26 per cent.²²

Heat recovery

The Carbon Trust, a UK-based company created to help organisations reduce their carbon emissions and become more resource-efficient, defines heat recovery as the collection and re-use of heat arising from a process which would otherwise be lost.²³ The use of heat recovery techniques can significantly reduce energy consumption, running costs and carbon emissions. In any given supermarket, the Carbon Trust calculates, you could supply 75-90 per cent of hot water demand from heat



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recovered from refrigeration. This could account for a significant 2-3 per cent of the building's total CO₂ emissions.²⁴

ABOVE:
Convenience store in Madrid.

CO₂ refrigeration systems in particular offer excellent opportunities from a heat recovery perspective owing to the refrigerant's higher critical pressure.²⁵ While it is far from being standard practice across the industry, several retailers have already implemented innovative heat recovery programmes. Aldi Süd has some striking statistics on the percentage of its stores which perform heat recovery from refrigeration, particularly at its Slovenian (100 per cent), Hungarian (100 per cent), Swiss (93.8 per cent) and Austrian (96.1 per cent) sites. EIA looks forward to seeing more progress at its operations in Germany, the UK and Ireland where the situation is less clear-cut. Jerónimo Martins is also making good progress on heat recovery, with 343 of its stores equipped with heat exchangers to recover hot air from the cooling systems.

4. GROWING THE GREEN ECONOMY

While large parts of the European economy have been struggling since the onset of the credit crunch in 2008, our green goods and services market has experienced consistent progress.

Early in 2013, Janez Potočnik, the EU Environment Commissioner, announced that since 2000 the EU's "eco-industry" has created over a million new jobs and is providing employment for well over three million people in total. However, even more impressive gains are to be had from more conventional industries, such as refrigeration, where support to switch to more sustainable operating methods will drive new green growth and export



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“ There will be both opportunities and challenges from the transition to a green economy and businesses will need to adapt to take advantage of benefits and manage risks. Impacts will be felt by sectors of the economy in different ways and to varying degrees ”

British Government, 2012²⁶

opportunities. **As Commissioner Potočník put it: “It is the greening of the wider economy that will create the most new jobs”.**²⁷

The European refrigeration and air conditioning (RAC) sector is part of that wider economy which has the capacity to become more environmentally friendly. Businesses need incentives to invest in production of climate-friendly refrigeration systems. **Clear-cut bans on the use of HFCs would create much-needed policy clarity for manufacturers wishing to invest in alternative technologies.** Bans create a well-defined policy direction, something key to stimulating any emerging economic sector. If bans on the use of HFCs are implemented in sectors, such as commercial refrigeration, where there are ample alternative technologies available, then we will accelerate the natural shift away from HFCs already under way and make a significant contribution to mitigating climate change in the long run.

Green skills

In addition to stimulating demand for climate-friendly sources of cooling, it is imperative that the RAC servicing

industry has adequate capacity to deal with increased demand for HFC-free cooling expertise. There is currently a shortfall of servicing skills for systems running on alternatives to F-gases in Europe. This in turn is discouraging the uptake of HFC-free refrigerants, even where more energy-efficient and cost-effective substitutes exist. While supermarkets are helping to raise awareness of the advantages of natural refrigerants for commercial use, more effort is required to bring the whole servicing industry up to speed. **We need a green skills strategy for the RAC sector, ensuring skills and training are adequate to meet the aspirations of a new green growth sector.**

The HFC issue is now receiving unprecedented attention, both at United Nations climate talks and the Montreal Protocol, which is considering amendments to globally phase down HFCs. Furthermore, just a few months ago, the two largest HFC producing countries, China and the US, agreed to work together to gradually eliminate HFCs. There is no better time for Europe’s manufacturing base to prepare itself to be at the forefront of the HFC-free revolution, and supermarkets have a hugely important role to play in spurring change.

5. EMERGING ECONOMIES

A sector with global reach - and corresponding responsibilities

A rapidly expanding middle class in countries such as China and Indonesia presents European retailers with obvious opportunities for growth. Already, Carrefour holds an 8.1 per cent share of the retail market in China,²⁸ while Tesco is executing plans to double the number of hypermarkets it operates there by 2015.²⁹ It is encouraging to see these and other European retailers applying the know-how acquired in home markets to their operations in emerging countries. **For instance, Tesco is installing HFC-free refrigeration across Asia, with six systems in South Korea and two in Thailand. It has also installed CO₂ refrigeration systems at four of its stores in China located in Ningbo, Beijing, Shanghai and Xiamen.**³⁰

At a workshop organised by the Chinese Association of Refrigeration with market development company Shecco in April 2013, Wei Qian of Tesco China went so far as to predict that: "In the near future, let's say three to five years, all new Tesco stores will adopt natural refrigerants."³¹ Carrefour is also introducing CO₂ refrigeration in its stores in China.³²

Latin American countries are also seeing a gradual spread of non-HFC technology in the retail sector. In Brazil, 14 supermarket chains, including Pão de Açúcar and Verdemar are all operating CO₂ systems.³³ Nationwide, there are now roughly 40 CO₂ cascade installations, up from 31 in late 2012.³⁴ High-end retailer Verdemar is adopting CO₂ cascade refrigeration systems as standard in new stores.³⁵ It reports that the **higher upfront costs associated with the new equipment are recouped within less than two years owing to reduced energy demand, the benefits of which are realised throughout the lifetime of the equipment.**³⁶ In addition to this, the Cometa chain recently installed a hybrid system running on CO₂ and HFC-134a at its store in the north-eastern state of Ceará, anticipating energy efficiency savings of above 20 per cent in comparison to traditional HCFC-22 or HFC-404A systems.³⁷

Following on from the impressive energy savings of its HFC-free systems discussed in Section 3, South African retailer Pick 'n Pay has converted an additional store at its own cost and is

now conducting further research with a view to making the technology standard across all stores.³⁸ On the strength of Pick 'n Pay's experience, another major South African supermarket chain, MAKRO SA, also decided to convert its cooling equipment to CO₂ technology.³⁹

Significantly, given the resistance to non-HFC solutions for higher ambient climates, many of the supermarkets pioneering climate-friendly cooling in emerging economies are doing so in temperatures well above the European average.

All eyes will now be on the European retailers which have not yet rolled out the expertise in HFC-free refrigeration acquired at home to their operations abroad. Belgian giant Delhaize Group, for example, which operates a growing number of stores in the Balkans and in Indonesia (under the Super Indo brand), should be taking measures to replicate the efforts in these new markets it is already making in Europe. Likewise, German giant METRO has stores in Egypt, India, Pakistan, China and Vietnam but currently has no HFC-free refrigeration systems in these countries.

These global companies have a responsibility to ensure that their growth in emerging retail markets does not lead to a corresponding surge in the use of HFCs. It is therefore vital that retailers step up current efforts to manage their refrigeration footprint both at home and abroad.

BELOW:

Carrefour holds an 8.1% share of the retail market in China.



© Shutterstock

“ Coop support a phasing out of HFCs in commercial refrigeration equipment. Refrigerants are a huge source of greenhouse gas emissions from the retail business, thus rapid reduction in the use of HFCs will make a positive environmental impact ”

Coop Norge

6. THE NEED FOR FURTHER LEGISLATION

The European Union is currently in the process of rewriting its F-Gas Regulation (N° 842/2006 on certain fluorinated greenhouse gases). Following a proposal by the European Commission which centres around phasing down the supply of HFCs to the EU market from 2015, the European Parliament has added various amendments, many of which recognise the need to support the phase-down with bans on HFC-containing equipment, including bans on the use of HFCs in new stationary refrigeration equipment from 2020 and hermetically sealed commercial refrigeration equipment from 2018.

During the past five years, EIA's *Chilling Facts* reports have documented

the ability of European businesses to adapt to change. The UK in particular is a prime example of this, moving from just 14 stores in 2008 to 428 HFC-free or HFC hybrid stores today; along the way, thousands of engineers have been trained to handle natural refrigerants. EIA believes that out of **the 21 retailers participating in this year's survey, 14 are on track to meet a ban on the use of HFCs in new commercial refrigeration equipment as early as 2015.**

The rapid rollout of climate-friendly refrigeration across Europe is proof of an industry ready for change. This has been supported by numerous independent studies. For example, a European Commission-funded study analysed the market penetration of alternatives on the basis that they were at least as energy efficient and safe to use, and confirmed that new HFC-based equipment could be prohibited from being placed on the market in 2020.⁴⁰ Furthermore, the study estimated that **banning HFCs in new commercial refrigeration equipment from 2020 would prevent over 559 MtCO_{2e} emissions through 2050, almost five times Greece's annual greenhouse gas emissions.**⁴¹

Consumer Goods Forum

In 2010 at the United Nations Climate Conference in Cancún, the Consumer Goods Forum (CGF) made a pledge to begin phasing out HFCs by 2015. Earlier this year, the Forum called on its members to make public their HFC phase-out commitments and start piloting HFC-free solutions.⁴²

At the CGF refrigeration summit in June 2013, it was revealed that 48 per cent of retailers have yet to make any public commitment to begin phasing out HFCs by 2015. This was reflected by participation in EIA's survey; of the 24 CGF members requested to participate, 10 refused. Among those which did participate, EIA has concerns over three retailers' readiness for the 2015 pledge.

EIA fully supports the efforts made by the CGF and some of its members to move away from HFCs. However, we are concerned that a significant number of CGF members do not appear to be making progress towards their 2015 goal to begin phasing out HFCs. It may be that some retailers are looking for a legislative signal before going further.



CONCLUSION

It is of the utmost importance that we look beyond the present and recognise the need to invest in the future, be it through adequate training of servicing engineers or taking lifetime equipment and running costs into account over initial capital expenditure. **This year's Chilling Facts report has documented the spread of HFC-free refrigeration across the globe. Critically, it has focused on the energy consumption of HFC-free systems where time and again it is proven that not only is there no penalty but, through attention to system design and a holistic planning process, there are in fact significant energy gains to be made.**

Despite the numerous successes documented in this report there is a need for leading global retailers to re-affirm their commitment to HFC-free refrigeration from 2015 and to honour this pledge across their entire global estate. EIA is concerned by the growing divergence between those retailers who

are taking their environmental responsibilities seriously and those who are not. We urge retailers to continue engaging in dialogue with one another in order to share experiences and build knowledge.

There is also an urgent need for governments and other policy-making bodies to introduce legislation which supports progressive retailers. This should include financial incentives which support HFC-free technologies as well as the provision of training for servicing engineers. Governments can also do much to encourage the uptake of more climate-friendly refrigeration systems by changing their own public procurement practices.

We are on the cusp of a global cooling revolution; a clear policy message now which signals the need to stop using HFCs in supermarket refrigeration will drive our green economy. We must not fail to seize the opportunity before us.

RECOMMENDATIONS

- Retailers must immediately commit to going HFC-free in all new stores and refurbishments with the aim of achieving an industry-wide phase out of HFCs by 2020
- Retailers should agree to fit doors on all chilled and frozen food units as standard
- Consumer Goods Forum members who haven't yet started piloting HFC-free systems should do so immediately
- The European Union should:
 - Ban the use of HFCs with a GWP >2500 from 2017
 - Ban of the use of HFCs in new stationary refrigeration equipment from 2020
 - Agree to a fast acting phase-down of the supply of HFCs
- Governments should support the shift to HFC-free technologies by investing in increased capacity of the RAC servicing industry to cope with increased use of natural refrigerants

GLOSSARY

Climate-Friendly

This term refers to refrigerants with a low global warming potential.

CO₂

Carbon dioxide is a greenhouse gas used as the base measurement to compare the impact of other gases in terms of their global warming potential (GWP); It is also used as a refrigerant.

GWP

Global Warming Potential; this determines the warming effect of a gas compared to the same mass of CO₂ released into the atmosphere.

Hybrid

Any system using two refrigerants for different parts of the cooling cycle; often these combine a natural refrigerant with an HFC, although sometimes both refrigerants are HFC-free.

Indirect emissions

Emissions from a refrigeration system resulting from the energy used to operate the system.

Integrals

A refrigeration system which is completely self-contained; integrals are also referred to as plug-and-play or stand-alone cabinets.

Natural Refrigerant

A group of five refrigerants that commonly exist in nature: air, ammonia, carbon dioxide, hydrocarbons and water.

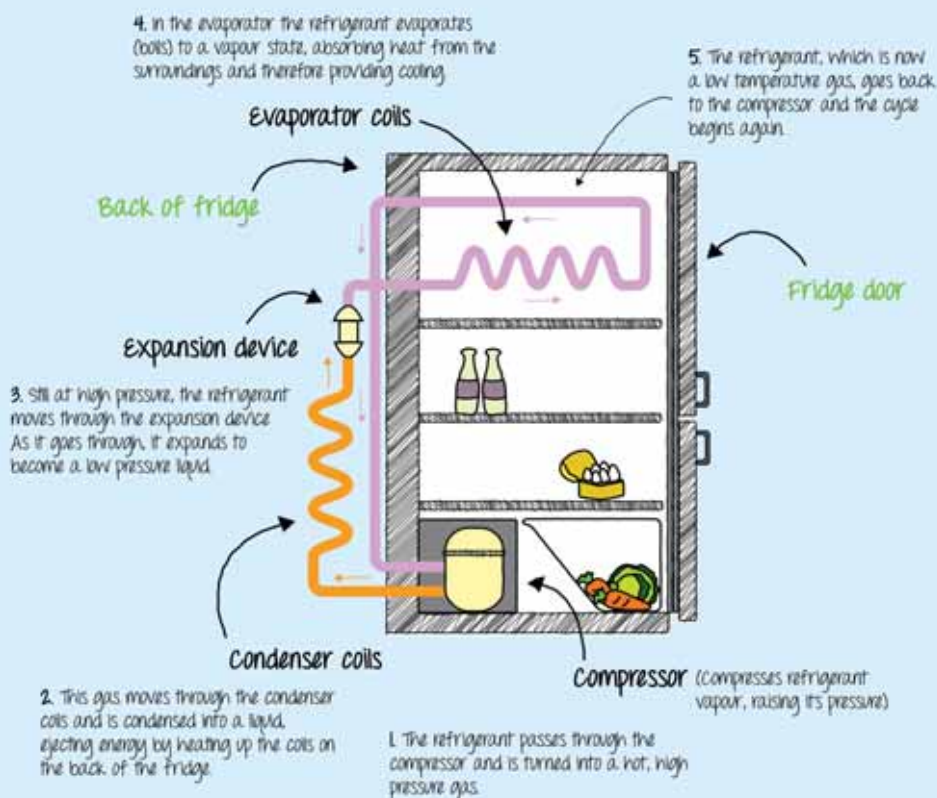
Subcritical CO₂ Cascade

Refers to a system using CO₂ in the low temperature cycle and another refrigerant in the medium temperature cycle.

Transcritical CO₂

Refers to a system using CO₂ in both the low and medium temperature cycles.

THE BASIC REFRIGERATION CYCLE



Design: Emma Clark

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