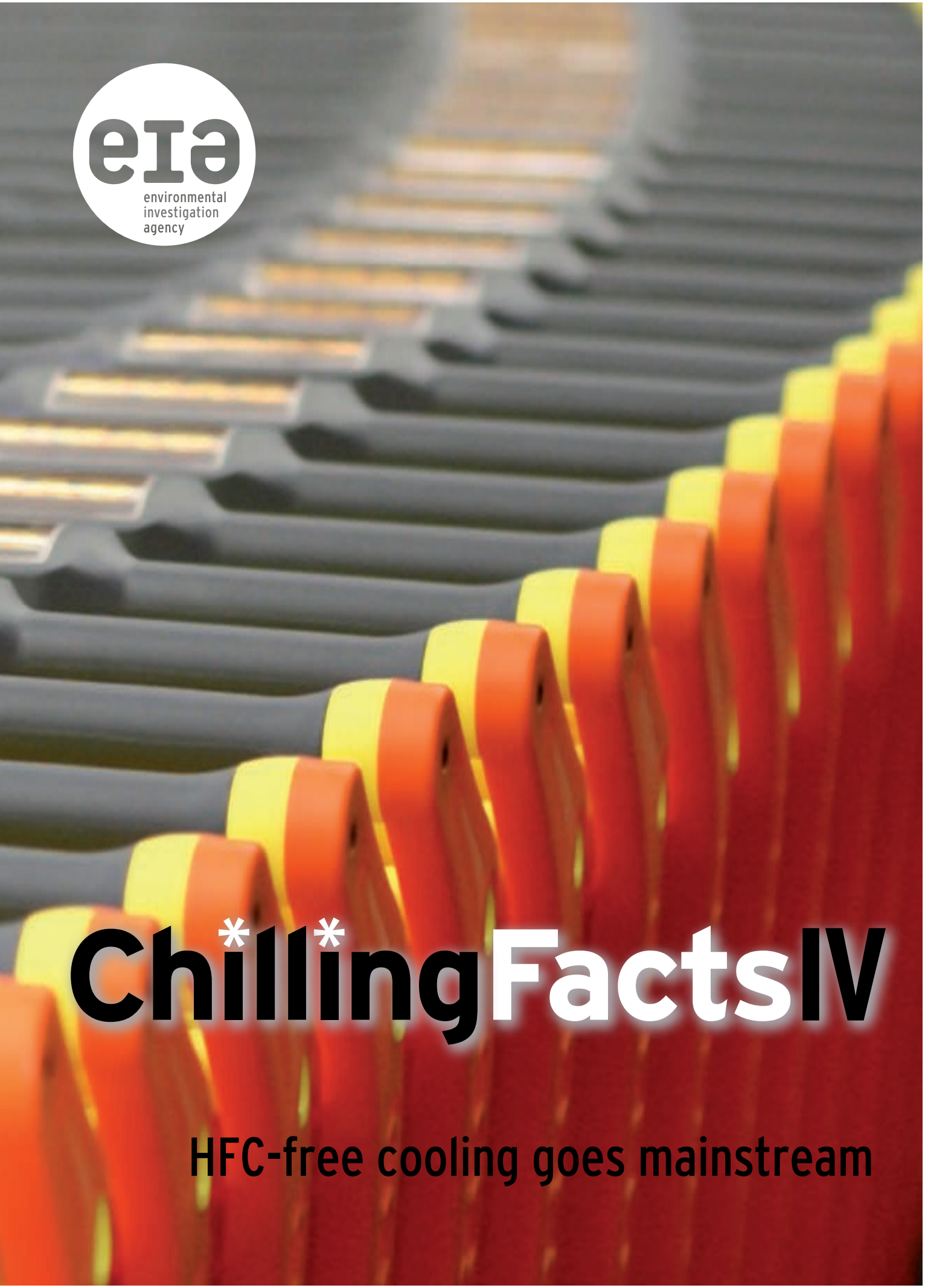

environmental
investigation
agency
Chilling Facts IV
HFC-free cooling goes mainstream

About EIA

EIA is a small charity set up over 25 years ago to fight environmental crime. We have developed innovative and effective investigative methods for defending the environment and seeking 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 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.

Background

EIA's annual Chilling Facts survey is now in its fourth year. Launched in 2008 it revealed a sector stuck in its ways, with just 14 stores across the UK using climate-friendly technology. HFC-free refrigeration technology was still perceived to be in its infancy and retailers raised concerns about the efficiency and costs of equipment and the lack of trained servicing engineers.

Four years on, EIA is pleased to report that HFC-free refrigeration has gone mainstream. 344 stores across the UK now use climate-friendly refrigeration systems with thousands of engineers trained to service them. And reality has debunked those efficiency myths, with retailers reporting significant reductions in energy use when compared to conventional HFC systems.

Since its launch, EIA's Chilling Facts campaign has successfully brought HFCs under the industry spotlight. Carbon-conscious retailers now recognise that super greenhouse gases have no place in supermarket refrigeration systems and that the writing is on the wall for HFCs.

EIA believes in the importance of sharing knowledge and we have presented our findings on commercial refrigeration around the globe. As well as comparing progress made by retailers we have also been able to share innovative best practice examples with technicians, managers and policy makers, and demonstrate the swift progress that the UK supermarket industry has made in just three years to roll out truly sustainable refrigeration.

In 2012, Chilling Facts has expanded to cover European retailers. The timing couldn't be better as this year the European Union is reviewing its policy on fluorinated greenhouse gases ('F-gases'), and is considering phasing out HFCs, a move which would without a doubt change the face of the global commercial refrigeration market. Findings from this year's survey reveal European retailers are ready for change, with many voluntarily committing to HFC phase-outs. The key thing that's needed now is legislation to level the playing field for progressive players and encourage reluctant retailers to take responsibility for their climate impact.

Publication date: July 2012

Chilling Facts – The Report

While we don't pull our punches when we encounter harmful and outdated practices, the aim of this report is also to give a voice to those retailers who have been at the forefront of the move away from HFCs. Without their efforts, the sweeping changes we have witnessed would simply not have been possible. However, while much progress has been made, some retailers appear to be treading water. There also remain a number of specific challenges ahead, such as in the area of food transport refrigeration. Fortunately, none of these obstacles is insurmountable. Indeed, as the report makes abundantly clear, tried and tested alternatives to HFCs are already out there. In some cases, a dash of ingenuity will be required but we're confident that the industry will be able to deliver lasting solutions to any remaining difficulties.

We received an impressive amount of data in response to our survey from supermarkets across the UK and Europe. It's impossible to do justice to all of that information in what is meant to serve as an overview, but the following pages will hopefully provide a useful guide to the current situation as well as highlighting areas in need of further attention.

From the outset, it's important to bear in mind that the retail sector is diverse: no two supermarket chains are the same. Nowhere is this more apparent than in companies' approach to refrigeration. For example, where some retailers have decided that their future will rely on hydrocarbons, others are rolling out CO_2 across their estates. As this report illustrates, challenges in both cases have been effectively addressed. Concerns about the flammability of hydrocarbons have been dealt with by ensuring that charge sizes are kept very low and adequate safety precautions are taken. In the case of CO_2, where the concern has been about 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 in many cases reduce energy use by an appreciable amount. For some purposes, such as air conditioning, many retailers are working to eliminate the need for refrigerant-based cooling altogether. Not-in-kind technologies are seeing growing popularity, with many supermarkets installing combined cooling heat and power (CCHP) or 'trigeneration' systems with absorption chillers providing cooling capacity. Only a small group of supermarkets have yet to accept the inevitable and fully commit to an HFC phase-out.

HFC phase-out and interim steps

An impressive number of the retailers we surveyed have signed up to the Consumer Goods Forum's resolution to begin phasing out HFC refrigerants as of 2015[1], with some of the pioneers like Waitrose, the Co-operative and Marks & Spencer committing to phase out HFCs altogether by a set date. In addition to this, actions are also being taken by some retailers to reduce their climate impact in the short term.

Indeed, Marks & Spencer in the UK, Carrefour in France and Delhaize in Belgium, are all introducing hybrid HFC-CO_2 systems as an interim measure before moving away from HFCs entirely. Marks & Spencer, for example, is using CO_2 circulated around re-used HFC packs. It's important to note that all of the supermarkets surveyed see the introduction of hybrid HFC technology as a stepping stone to a full phase out of HFCs. It is also very important that those supermarkets which do avail themselves of this transitional technology establish clear timelines for phasing out HFC use. Carrefour, for example, has stated that it will begin a full-scale rollout of HFC-free technology as of December 2013[2].

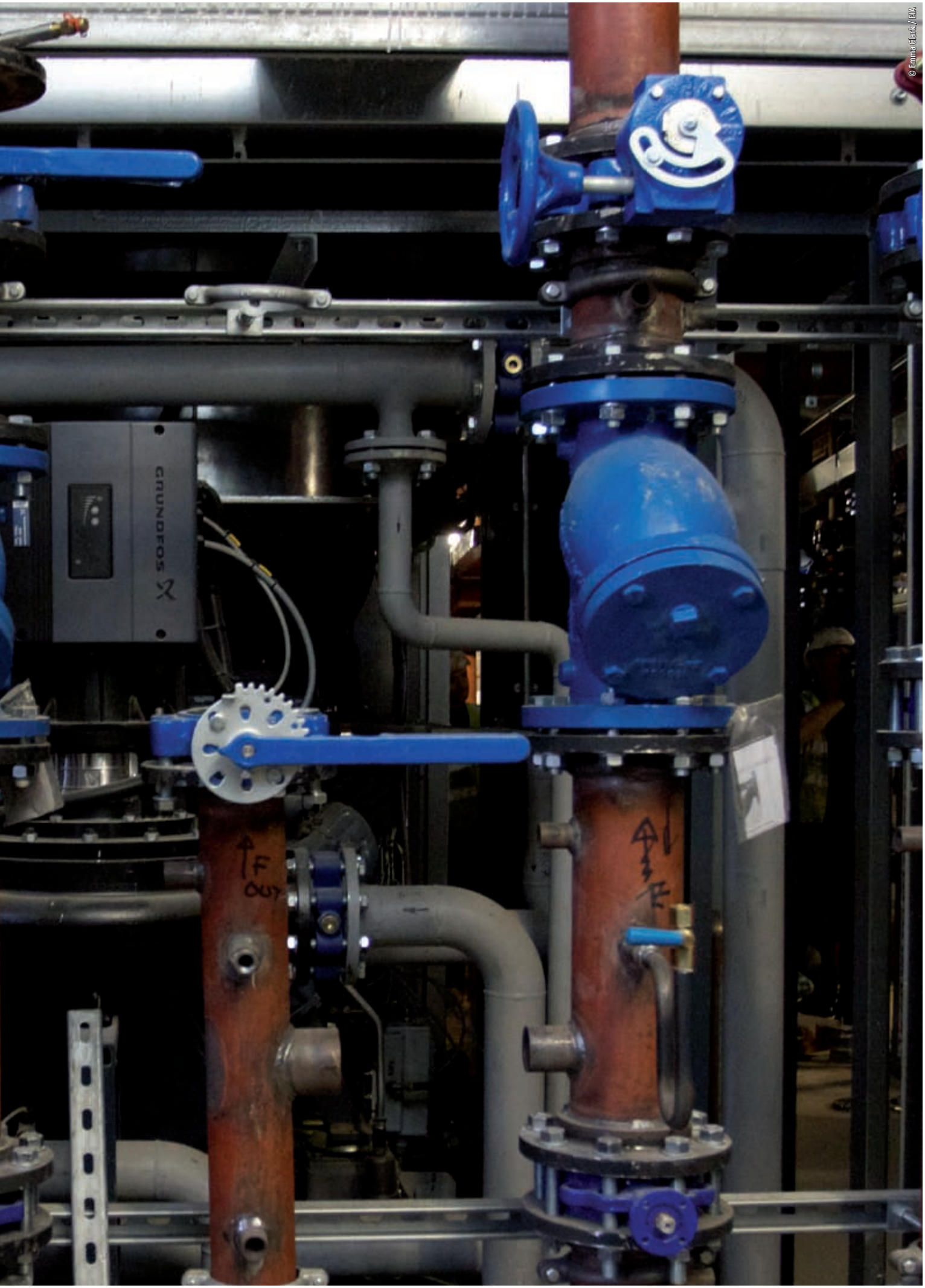
Another useful interim step that is being taken is the replacement of HFCs with very high global warming potentials (e.g. HFC-404A, which has a GWP of around 4,000) with lower-GWP HFCs. Again, this is a good transitional measure but it should not distract retailers from the overarching objective of being HFC-free.

Food transport refrigeration

Progress on identifying sustainable alternatives for food transport refrigeration remains extremely disappointing. This is a concern. Food transport refrigeration is by its very nature leaky (all those bumps in the road don't do the pipe work any good!) and with the growing popularity of home delivery it is an area that needs to be addressed with utmost urgency. While some supermarkets continue to trial options, we get the feeling that retailers have put the quest for solutions on the backburner. This is simply not good enough and we urge them to put this issue firmly back on their priority list for 2012/13.

Finally, this year's survey has thrown up some impressive examples of supermarket innovation. It's gratifying to see that more and more retailers are taking a genuinely holistic approach to refrigeration, treating it as one aspect of the whole, rather than looking at it in isolation. There are some excellent examples of this kind of 360^0 approach, from Waitrose's Energy Centres to the construction of Coop's new sustainable headquarters, lessons from which will feed into the company's overall cooling policy going forward.

Combined Heat and Power system at the Co-operative HQ in Manchester



Key findings for 2011: UK

This year EIA has not ranked retailers as we feel that the leaders are converging in their efforts. We have been particularly impressed by the rapid roll out of HFC-free refrigeration by Sainsbury's* and Waitrose. We are however concerned over Tesco's apparent progress. In 2009 it announced plans for 150 HFC-free stores by 2012, yet they are just over one third of the way towards their target. This is disappointing given that Sainsbury's has passed the 100 HFC-free stores mark. Discounter retailers Aldi and Lidl have made good progress rolling out energy efficient HFC-free freezers, but we're still waiting for a similar roll out in their chilled food systems. Iceland is still trailing behind the bunch, but is at least trialing HFC-free equipment.

Leaders of the pack: retailers shaded in green have made an explicit commitment to move away from HFCs.

Marks & Spencer

Good

Committed to HFC phase-out by 2030.

Big emissions reductions, have already met their 2015 target.

Have increased number of stores running on climate-friendly technology from 25 to 42, however these are mostly hybrid HFC-CO2.

Improved energy efficiency per sq ft by 28% over past 5 years.

Bad

No movement on food transport or air-conditioning.

They need to speed up transition from HFC-CO2 hybrid technology to HFC-free.

Still assessing a trial on fridge doors in 2011.

Co-operative

Good

Committed to HFC phase-out by 2030 with all new stores HFC-free.

15% of refrigeration now running on naturals, up from 5% last year.

Use of HFCs in distribution centres down again this year with 60% of distribution centre space cooled by ammonia (NH3).

Rolling out chiller doors in 2000 convenience stores and a limited programme in larger stores.

Bad

Lack of movement on transport refrigeration.

Lidl

Good

Increased number of HFC-free freezer cabinets by 7.2%, bringing total number to 7,236.

Has confirmed that all new freezer cabinets and replacements will use propane as refrigerant and that all new distribution centre installations & replacement of existing plants will exclusively use natural refrigerants.

Very low leakage rates.

Uses AC in just 5% of stores.

Bad

No HFC-free commitment made yet.

Have rejected chiller doors due to alleged negative impact on turnover.

* Sainsbury's is not included in the results table as they did not participate in the survey

Results from UK retailers have shown a 44% increase in the number of stores using climate-friendly technology since last year's report

Waitrose

Good

Committed to total HFC phase-out by 2020.

Now have 67 HFC-free stores representing 25% of their total estate.

Four audits have reduced leakage from 1.4 leaks per store to 0.4.

Recirculates cool air from chiller cabinets to reduce need for AC.

Bad

Lack of movement on transport refrigeration.

Tesco

Good

Direct emissions down 23% on last year's suggesting tangible effects of conversion to CO2 refrigeration.

Have increased HFC-free stores outside UK from 23 to 51.

Rolling out natural ventilation stacks to reduce need for AC.

Rolling out doors on fridges in smaller format stores.

Bad

Concerned UK roll out of HFC-free refrigeration is stagnating with just 14 new stores this year. Falling way behind plans to convert 150 stores by 2012.

Opened 60 new stores in Poland using HFC-based systems, despite their previous commitment to go HFC-free in all new stores.

Aldi

Good

Has rolled out high efficiency variable speed compressor HC freezer cabinets since 2007, now has 5145 cabinets in use.

Doesn't use AC in stores.

Bad

No HFC-free commitment made yet.

High leakage rates, reflected in relatively high direct emissions per store.

Has 7 transport refrigeration systems still running on HCFCs.

Has rejected doors on fridges based on Aldi Germany's trials.

Iceland

Good

Have made significant in-store energy savings.

Reduced direct emissions per store by 17%.

Trialling HFC-free equipment.

Use of free cooling means stores don't need AC.

Bad

No HFC-free commitment made yet.

Remain far behind their competitors in transition away from HFCs.

Key findings for 2011: Europe

This is EIA's first year reporting on European retailers outside the UK. Ten retailers from across Europe responded to our survey revealing they have converted 559 stores to climate-friendly refrigeration.

Responses have shown a wide regional variation in prioritising climate-friendly cooling, with more progressive retailers based in Northern Europe. Coop Switzerland has made the biggest steps towards phasing out HFCs with 135 stores running on HFC-free refrigeration. Other leaders include Ahold Netherlands with 175 hybrid HFC-CO_2 stores and Migros Switzerland with 149 hybrid and HFC-free stores.

Southern and Eastern European retailers such as Alpha Beta in Greece, Mega Image in Romania and Mercator in Slovenia have done very little to phase out HFCs. Alpha Beta has one store using an HFC-CO_2 hybrid system while Mercator has one planned.

Hungary appears to be a success story for HFC-free refrigeration. Tesco now has 35 stores running on HFC-free systems in the country, up from 22 last year. This is in stark contrast to its estate in Poland, where Tesco recently built 60 new stores running on a refrigerant blend with a global warming potential of approximately 2,000. Given the company's commitment to phase out HFCs, this move seems short-sighted at best and is a worrying development. Last year Tesco pledged to "aim to roll out natural refrigeration to all new stores in the UK and Central Europe and [will] continue to accelerate the installation of natural and energy efficient systems in the years after this." Is Tesco reneging on this commitment already?

Information from the rest of Europe shows how some UK retailers are falling behind the times with their negative approach to doors on chilled food. Retailers Alpha Beta, Ahold, Co-operative Norway, Delhaize, Metro and Mega Image are all rolling out doors on chilled food cabinets within their estate. In contrast just two UK retailers, Tesco and Co-operative UK have made similar commitments.

Leaders of the pack: retailers shaded in green have made an explicit commitment to move away from HFCs.

Migros, Switzerland

Good

Committed to going HFC-free in all new stores.

149 stores running on climate-friendly refrigeration (either totally HFC-free or hybrid HFC-CO2 systems).

Store data reveals energy efficiency gains of HFC-free refrigeration over HFC-based systems.

Bad

Only 3% of chilled food cabinets have doors.

Incomplete survey, information missing on types of systems used across sectors.

Carrefour, France

Good

Part of CGF commitment.

40 stores running on hybrid HFC-CO2 technology as an interim step with two HFC-free stores in the planning.

Recognises HFC-free refrigeration is cheaper than HFC options over the lifecycle of the system.

Has signed French Retailers Federation (FCD) commitment to roll out doors on fridges to all store formats and is currently testing doors on fridges in 8 stores.

Bad

Has a big leakage problem with annual rates of 25%.

Leaking refrigerant accounts for 41% of its carbon footprint.

Incomplete survey, information missing on types of systems used across sectors.

Mega Image, Romania

Good

Low direct and indirect emissions.

All new stores have glass doors on meat cabinets, all new stores will have 15% of chilled cabinets fitted with doors.

Bad

No current use of climate-friendly refrigeration.

Incomplete survey, information missing on types of systems used across sectors.

9% of estate still uses HCFCs.

Coop Norway

Good

Committed to HFC-free refrigeration in all new stores.

Already using HFC-free refrigeration in 30+ stores.

Rolling out doors on chillers to all new stores and refurbishments.

Bad

Distribution centres run on HFCs and HCFCs. However, they will be opening a new distribution centre using natural refrigerants in 2014.

Incomplete survey, information missing on direct and indirect emissions, types of systems used across sectors and leakage rates.

Ahold, Netherlands

Good

Part of CGF commitment.

Has approximately 20% of its estate - about 175 stores - running on hybrid CO2-HFC technology as an interim step.

Rolling out chiller doors, now in 70% of stores.

Consistently low leakage rates.

Piloting HFC-free refrigeration.

Bad

Needs to speed up roll out of HFC-free refrigeration with only one HFC-free store in existence.

Coop Switzerland

Good

Uses HFC-free refrigeration in all new stores and refurbishments since 2010.

135 stores running on HFC-free refrigeration.

Bad

Only using doors on chilled fish cabinets, should roll out to all chilled food.

Incomplete survey, information missing on types of systems used across sectors and leakage rates.

Metro, Germany

Good

Part of CGF commitment.

Using HFC-CO2 hybrids and piloting HFC-free cooling.

Uses doors on almost all chilled food.

Year-on-year reductions in leakage rates.

Uses HFC-free cooling in 7 distribution centres.

Bad

High direct emissions. Worryingly, the company reports a rising refrigerant refill rate at its Metro Cash & Carry, Real and Galeria Kaufhof sales divisions.

Sparse mention of HFCs in CSR report.

Incomplete survey, information missing on types of systems used across sectors.

Seems unprepared for its 2015 HFC-free commitment, needs to speed up roll out HFC-free stores.

Delhaize, Belgium

Good

Part of CGF commitment.

61% of stores have doors fitted to chilled food, rolling out through entire estate.

Has saved over 13,500 tonnes CO2e in past 3 years.

Reduced leakage rates from 16.6% in 2008 to 10.92% in 2011.

27 stores running on HFC-CO2 hybrid technology as an interim step, planning roll out of 15 per year.

Use of HFC-free cooling in 16 distribution centres.

Bad

Incomplete survey, information missing on types of systems used across sectors.

Needs to speed up roll out of HFC-free systems.

Mercator, Slovenia

Good

Some use of HFC-free cooling in distribution centres.

Is planning installation of an HFC-CO2 hybrid system.

Bad

No use of climate-friendly refrigeration in stores.

Has not articulated any HFC phase-out plans.

Needs to work on rolling out chiller doors, as yet only 0.03% of stores have them fitted.

Incorrectly claims HFC-free options are not viable in distribution centres.

Alpha Beta, Greece

Good

Use of HFC-free cooling in two distribution centres.

Has fitted 25% stores with chiller doors, rolling out to entire estate.

Uses waste heat for hot water production.

Bad

Just one store fitted with CO2 for frozen food.

Ongoing use of HCFCs.

High direct emissions per store, suggesting high leakage rates.

Has not articulated any HFC phase-out plans.

Chilling Facts: The Key Issues

1. Use of Natural Refrigerants

The roll out of climate-friendly refrigeration is now well underway across much of Northern Europe with almost 1000 stores now using these technologies. **Results from UK retailers have shown a 44% increase in the number of stores using climate-friendly technology since last year's report**, bringing the total number of stores to 344. Responses from a limited number of European retailers have revealed some serious efforts with 559 stores having been converted. A recent report produced by Shecco suggests the overall number could be much larger, stating that 1,331 stores across the EU are running on transcritical CO_2 technology[3].

There are several different types of system in use. Transcritical CO_2 uses CO_2 as a refrigerant in both the chilled and frozen food temperature cycles, while subcritical CO_2 technologies use CO_2 only in the frozen food temperature cycle and use either hydrocarbons or HFCs in the chilled food cycle. These are commonly referred to as hybrid technologies. Integral cabinets are used by smaller format stores. Similar to domestic equipment (as the refrigerant change and compressor is held within the unit), these can use either HFC or HFC-free refrigerants. UK retailer Waitrose has developed a simple hydrocarbon based system which uses hydrocarbon cooled integral cabinets in conjunction with water cooling to keep charge sizes low.

EIA's fourth Chilling Fact's report shows that a large and increasing proportion of food retailers have recognised that the use of HFCs is not sustainable and that they are voluntarily investing in more climate-friendly alternatives.

Consumer Goods Forum commitment to HFC-free refrigeration from 2015

At the 2010 UNFCCC meeting in Cancún members of the Consumer Goods Forum (CGF) made a commitment to begin phasing out HFCs by 2015[4].

With over 650 members from retail, manufacturing and service providers across 70 countries a commitment of this scale will have a global effect on the proliferation of HFC-free technology.

EIA's survey has shown how seriously some retailers are taking this commitment with many retailers now recognising that investments in HFC-based technologies are short-sighted and instead looking to sustainable alternatives. Retailers Tesco, Sainsbury's, Coop Switzerland, Coop Norway, Migros, Co-op UK and Waitrose have all committed to HFC-free refrigeration in all new stores.

Another group of retailers, Carrefour, Marks & Spencer, Delhaize, Ahold and Metro Group, is opting for the use of hybrid HFC-CO_2 technology as an interim step before rolling out totally HFC-free cooling from 2015.

Other European retailers Mercator and Alpha Beta are CGF members but have not yet articulated HFC phase-out plans.

Finally UK retailers Lidl, Aldi and Iceland have yet to make a commitment to transition to HFC-free technologies.

HFC-free is cheaper in the long-run

Not only is HFC-free refrigeration more environmentally sustainable but it also makes economic sense. One challenge often cited by retailers who are considering HFC-free refrigeration is the additional costs involved. However information supplied by retailers suggests that HFC-free systems are in fact less expensive when considered over their lifetime. Carrefour estimates operational cost savings from HFC-free systems to be in the order of 15%, with hybrid systems saving about 8% over conventional systems. Given that operational costs usually represent about 70–75% of total equipment costs[5] it would seem that HFC-free systems already make business sense.

> *"Transition to natural refrigerants is probably one of the most vital and effective environmental measures to be undertaken in retail today and should be promoted"*
>
> Coop Norge

Co-op estimates that improvements in energy efficiency across its estate saved it roughly £1,000 an hour throughout 2011.

2. HFC-free refrigeration and energy efficiency

This year's survey responses have again demonstrated that energy efficiency and moving away from climate-warming HFCs go hand in hand. The properties of the actual refrigerant used are of course a vitally important part of the equation. Many retailers report impressive direct emissions reductions based on the transition away from HFCs given that alternatives have markedly lower global warming potential. However, system design and maintenance are just as important in terms of securing reductions in indirect emissions (energy consumption) or ensuring that indirect emissions remain stable with the switch to the new refrigerant. It therefore does not make sense to consider one aspect independently from the other. Replacement of high-GWP HFCs with lower-GWP HFCs as an interim measure is also providing tangible energy savings.

Hydrocarbons

Aldi provides a good example of the energy savings made possible by the switch to hydrocarbons. It has 5,145 hydrocarbon freezers installed across its estate, netting energy savings of 1,871,136 kilowatt hours (kWh) per year, the equivalent of nearly 1,000 tonnes of CO_2 annually. HC-290 (otherwise known as propane) has been introduced to all new freezer cabinets installed since September 2007. Aldi estimates that, along with the use of advanced electronic controllers and variable speed compressors, the indirect CO_2-equivalent (CO_2e) emissions per unit have dropped by 14% and direct emissions (refrigerant leakage) have plummeted by 99.9% in comparison with the previous HFC systems.

Likewise, Waitrose reports that "Installing hydrocarbon water-cooled refrigeration systems with cold air retrieval and integration to heating systems represents a significant shift away from traditional refrigeration standards. The new systems save considerably on gas, electricity and radically reduce the impact of refrigerant gas losses."

Carbon dioxide

CO_2 systems have been rolled out in approximately 1,500 supermarkets across Europe[6]. As well as providing energy efficiency benefits in many applications, there is better scope for waste heat recovery with CO_2 than with any other refrigerant. Recent Swiss research comparing HFC-134a and CO_2 reports up to a 40% increase in heat recovered at normalized refrigeration power input[7].

In Switzerland, supermarkets report improved energy efficiency from using CO_2 systems. Coop Switzerland states that "At already 135 stores CO_2 is used as a refrigerant – the electricity need is reduced by 25% compared to former[ly] used refrigerants."

Studies carried out by the Swiss consultancy LKS FroidSuisse for Coop Switzerland show that low temperature transcritical CO_2 systems lead to a reduction in energy consumption per linear metre of cabinets from 4,500 kWh to 1,400 kWh[8].

According to the Danish authorities, the second generation of transcritical CO_2 systems use approximately 10% less energy in Northern Europe compared to similar HFC systems. In Central Europe the figure amounts to approximately 5% less energy. In Southern Europe, the systems have to be tailor-made due to a higher ambient temperature, and in some cases cascade systems with subcritical CO_2 systems have to be used. The transcritical system is superior in most parts of Europe because they operate sub-critically most of the year[9].

In the same vein, Coop Norway says "The essential point is optimising the total energy use in stores. Optimised systems [...] consume less energy and produce less heat. [...] In general, optimised CO_2 systems are more energy efficient." This view is shared by many experts across the industry.

At Marks & Spencer, the first major [UK] retailer to be certified as carbon neutral[10], a major rollout

> *It is important not to think the same way as before. If you make the system the same way as a conventional system you are bound to fail… we always need to think one step ahead to think where we want to go.*
>
> Pega Hrnjak, Res. Professor, Dept. of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign [14]

of CO_2 systems is underway, combined with the interim replacement of HFC-404A with HFC-407A. Switching to a lower GWP HFC refrigerant as an interim step has provided energy efficiency improvements of around 10%. As the result of various measures they have introduced, Marks & Spencer has achieved energy efficiency improvements of 28% per square foot to 41.5 kWh/sq ft (2006/07: 57.4 kWh/sq ft)[11].[i]

And while Marks & Spencer states that "Current CO_2 technologies do not yet provide the energy efficiency to match HFC solutions" it also notes that "Current trials underway [in] new pump developments and improved display case efficiency are expected to improve the current position."

Tesco reports that "The use of CO_2 as a refrigerant has shown us energy savings on certain types of system. We use suction optimisation to maximise energy efficiency and we ensure we float the head pressures on the plant and use energy efficient condenser fan motors." On average, Tesco has found that non-HFC systems deliver energy savings of around 5% in comparison to HFC systems. This figure is an average across the Tesco group and includes installations in different climates.

Tesco's Corporate Responsibility Report 2011 states that "This year, thanks to a relentless focus on refrigerant emissions as well as further progress on energy efficiency, we have reduced our absolute CO_2e emissions in the UK by 5%."[12]

Tesco's zero-carbon stores are designed to use as little energy as possible. For example, its heating and cooling system at Ramsey, Cambridgeshire (built 2009) uses 66% less energy than a typical store of a similar size.[13]

This highlights the importance of adopting a holistic approach to refrigeration, which prioritises good system and component design. Knowledge sharing is also a key part of the equation.

Co-op estimates that improvements in energy efficiency across its estate saved it roughly £1,000 an hour throughout 2011.

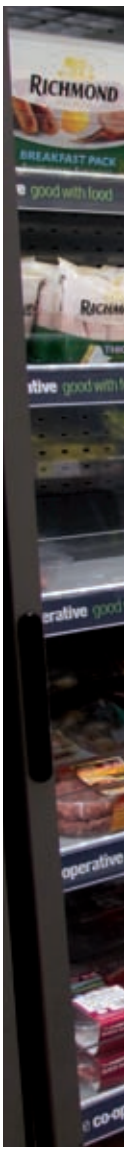
Doors on fridges

Across the board, there appears to be an understanding that relatively cheap and simple measures such as the placing of doors on freezer cabinets can have a huge impact on CO_2e emissions from energy consumption. In fact doors on freezers have become pretty much standard across the industry, both in the UK and European supermarkets. What is less well recognised are the benefits of installing doors on fridges, with some retailers raising concerns about the impact on sales.

However, two major UK retailers, the Co-operative Group and Tesco, have been busy disproving these claims. Coop recently announced changes to its doors on fridges policy with a commitment to roll out doors to over 2,000 of its convenience stores as they replace the refrigeration systems. It plans to deliver 200 of these in 2012 with a batch of pilot stores (5–25) in their larger format stores and a limited programme of door retrofits in 700–900 stores. The doors are sliding, which minimises air changes and all use LED lighting, saving further energy. Coop is also piloting reducing the overall store light level to further improve the appearance of the doors and save extra energy. They report that doors are having a significant impact on store heating and air conditioning requirements. In addition to this, the majority of their freezer doors supplied in 2012 will be unheated.

Coop reports an impressive range of benefits associated with doors on fridges. Their own market research has shown that doors have absolutely no negative impact on purchasing behaviour. On the contrary, customers perceive that the produce is fresher, cleaner and more appealing. Unintended positive consequences also include a reduction in shoplifting and less frequent maintenance. In addition to this, fitting doors has led to impressive energy savings. Combined measures (including doors, the use of hydrocarbons, LED lighting and heat recovery) have led to a 90% drop in natural gas usage, 40% energy savings, approximately 80% carbon savings, and increased sales.

Similarly, all new Tesco Express stores are also fitted with doors on chillers (except within the fruit and vegetable sections). Most of Tesco's new Metro stores



i 1 foot = 0.3048 metres

also have doors fitted on cabinets and the retailer plans to carry out a number of retrofits in its existing Express stores. Doors are also fitted to Tesco's Zero Carbon Superstores.

At Ahold Europe, new-generation refrigerators and freezers are fitted with doors, LED lighting and low-energy fans. These reduce energy usage by approximately 20%. Additionally, Ahold estimates that putting doors on fridges saves about 20% energy per metre of cooling cabinets, which represents about 3% of a store's total electricity consumption.

French retailers' commitment:

In January 2012, the association of French retailers (Fédération des Entreprises du Commerce et de la Distribution – FCD) made a groundbreaking commitment[15] to roll out doors on fridges to all store formats – hypermarkets, supermarkets and convenience stores. The move will affect 75% of French supermarkets' 700 km of chillers by 2020. It is estimated that energy consumption will "drop significantly" – by up to 50% according to one study[16]. Refrigeration systems represent around 50% of energy consumed by French supermarkets. By 2020, the move will represent annual energy savings of 2.2 terawatt hours, which is equivalent to the annual energy consumption of Lyon, France's second largest city after Paris. Another aspect highlighted at the time of the announcement was the improvement in customer comfort – no need to put on your woolly hat when you pop in to buy a baguette! As Nathalie Kosciusko-Morizet, France's former Environment Minister pointed out at the time of the French retailers' announcement "It's common sense. Do you leave your fridge door open at home? That's what's happening in supermarkets."[17] The agreement has been signed by Auchan, Carrefour, Casino, Cora, Francap, Monoprix, Simply Market and Système U and some retailers in the UK already seem to be eyeing a similar move.

Pipework and outlet of the free cooling system at the Co-operative HQ in Manchester


© Emma Clark / EIA

3. Leakage

Why does it matter?

It is well documented that commercial refrigeration systems typically suffer high leakage rates (in the region of 15%), much higher than those in other sectors.[18] In addition many systems have extremely large refrigerant charges – up to 3,000 kg in hypermarkets[19]. This means that the carbon footprint from direct emissions in supermarket refrigeration systems is often greater than that associated with energy used by those systems. In our first survey of UK supermarkets in 2009, EIA found that the CO_2 impact of direct emissions was 1.65 times higher than that of indirect emissions[ii] associated with refrigeration. Following a significant shift to HFC-free refrigeration and improved containment, UK retailers' direct emissions are now half of their indirect emissions[iii].

However the information supplied by European retailers outside the UK shows that direct (refrigerant) emissions in 2011 are still higher than indirect emissions by refrigeration systems, on average 1.26 times higher[iv]. The enormous leakage from HFC-based systems in Europe can mean that even if the systems had no energy-related emissions, their carbon footprint would still be larger than that of a typical HFC-free system.

This information shows just how significant the leakage impact is. Carrefour, the world's second largest retailer has revealed that leakage from refrigeration accounts for 41% of its carbon footprint, resulting in annual direct CO_2e emissions of 395,616 tonnes . Not only is this having a significant detrimental impact on the climate but it is also costing the retailer in the order of €9 million each year to top up the leaky systems.

Ongoing excessive leakage rates from European retailers in 2011, four years after the implementation of containment measures embodied in the F-gas regulation, shows clearly that the Regulation in its current form is simply not working.

Retailers go beyond F-gas regulations.

The responses from the retailers for this year's survey show clear commitment from many to cut HFC emissions, with several going significantly beyond current regulatory requirements.

Many retailers track and manage their refrigerant use through central databases. For example, Metro Group has introduced electronic logbooks to optimise refrigerant loss monitoring, while the current F-gas regulation merely requires paper logbooks. Analysis of electronically collated data enables a much more precise understanding of refrigerant loss and usage and thus enables targeting of problem stores.

Several UK retailers have also recognised the importance of external auditors to help reduce leakage rates. For example Waitrose employ independent engineers to carry out leak detection using mobile systems. These 'secret sniffers' were tasked to identify the potential for future leaks as well as current leaks in stores. As a result the number of leaks per store visited has dropped from 1.4 to 0.4 since 2010. The Co-operative Group also employs a team of outside auditors to ensure that their maintenance team is meeting its targets.

Engaging with contractors to explain the vital importance of leakage reduction in reducing a retailer's carbon footprint can also help. For example Ahold holds a monthly meeting with its refrigeration partners on measures to be taken to reduce leakage.

4. Regulating the use of HFCs

Supermarkets and the F-Gas Regulation

The use of HFCs is regulated in Europe by the F-Gas Regulation (EU Regulation N° 842/2006 on certain fluorinated greenhouse gases). Introduced in 2006 it relies predominantly on measures aimed at containing and recovering HFCs. However, five years on, experience has shown that this approach is both ineffective and expensive and that it will continue to fail unless comprehensively revised.

As part of an ongoing review of the Regulation, the European Commission recently published an independent study demonstrating that in the best case scenario of full implementation, the F-Gas Regulation will only serve to stabilise EU HFC emissions from commercial refrigeration at around 20 million tonnes of CO_2e per annum between 2020 and 2050[20].

The study highlights key sectors where use bans and placing on the market restrictions can be most effective. Findings from the commercial refrigeration sector show that new HFC-based equipment could be prohibited from being placed on the market in 2020.[21] These measures would prevent cumulative emissions of 559 million tonnes of CO_2e by 2050,[22] equating to just under the UK's annual greenhouse gas emissions.[23]

ii Supermarkets included in this figure: Tesco, Asda, Marks & Spencer
iii Supermarkets included in this figure Marks & Spencer, Waitrose, Coop UK, Iceland, Lidl UK, ALDI
iv Supermarkets included in this figure Delhaize Belgium, Alfa Beta, Mega Image, Metro Group, Migros

The F-Gas Regulation already contains the framework for tackling HFC emissions through use bans and placing-on-the market prohibitions. EIA and a large coalition of European NGOs are calling for all new HFC-equipment in the commercial refrigeration sector to be banned by 2020.

Other European legislation

Several European countries including Denmark, Switzerland, Norway and Sweden, already have national legislation in place to prohibit or restrict the use of HFCs and/or promote the uptake of alternatives. These have resulted in the widespread development and uptake of HFC-free technologies in those countries.

The case of Denmark

In a pioneering move in 1996, Denmark's Minister for the Environment, Svend Auken, announced plans to phase out HFCs in Denmark[24]. Denmark now has a ban on all HFC uses except for applications with a refrigerant charge between 150g and 10kg and a tax on F-gases. The gases with the greatest impact on climate are subject to the highest tax level[25]. For the most frequently used F-gas refrigerant (HFC-134a), the tax amounts to DKK 195 (app. 26 Euro) per kg. As a result of these measures, natural refrigerants are now standard in all new refrigeration equipment above a certain capacity.[26] In fact, as Shecco, a market research and public affairs consultancy for the natural refrigeration industry, reports: "With its tax and restrictions on HFCs, Denmark has a higher penetration rate of CO_2 systems than any other country in the world."[27]

A recent paper notes that in Denmark "CO_2 (transcritical) is now standard in supermarket refrigeration, ammonia is standard in big chillers and in industrial refrigeration systems, hydrocarbons are standard in medium-sized chillers and hydrocarbons (R290 and R600a) are standard in commercial stand-alone units. [...] The consumption of F-gases has been reduced by almost 2/3." [28]

5. Innovation

Marks & Spencer's Sustainable Learning Store and 'whole life costing model'

In September 2011, Marks & Spencer opened a new Sustainable Learning Store at Stratford City near the site of the London 2012 Olympic Games. The store features hydrocarbon refrigeration, sunpipes to maximise natural light and a living roof. Stratford City store obtains 99% of its heating and cooling energy from a central combined cooling heat and power supply. No waste was sent to landfill during its construction and it has been awarded an 'Excellent' BREEAM rating.

Marks & Spencer will be opening its largest Sustainable Learning Store to date at Cheshire Oaks later in 2012. The retailer has also put in place 'green' tariff electricity contracts for all the electricity they buy directly from April 2012. These contracts include 15% of electricity from small-scale generators, including a new Archimedes screw water wheel installed on the Thames at the Mapledurham Estate.

The company has also adopted a novel approach to costing with its 'whole life costing model' focusing both on the store as a whole and on individual components such as refrigeration and lighting. These enable the retailer to make more informed decisions about the operational running costs of designs and specifications.

Coop UK's new HQ - 1 Angel Square

Billed as one of the most sustainable buildings in Europe, Co-operative Group's new headquarters, which is nearing the final stages of construction, will be one of the largest buildings in Europe to have the BREEAM[v] "outstanding" rating. The use of natural refrigerants is one of three principle drivers which have guided construction and Co-op is currently working with the BRE (Building Research Establishment) on ways of applying the standard to the rest of their estate.

Cooling requirements will be met using a combination of the following, with the main focus on free cooling and the hydrocarbon chillers for back up:

- Free cooling recovery
- Subterranean earth cooling recovery
- 746kW absorption chillers directly matched to two 746kW pure plant oil (PPO) combined heat and power (CHP) units
- Hydrocarbon (propane – R-290) chillers providing 3.2MW of cooling

Coop uses pure plant oil for the absorption chillers made from rapeseed grown on their own estate. It plans to use the surplus heat generated to supply surrounding buildings as part of a district heating system.

v BREEAM is an environmental assessment method and rating system for buildings. A BREEAM assessment uses recognised measures of performance, which are set against established benchmarks, to evaluate a building's specification, design, construction and use http://www.breeam.org/index.jsp

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With the new HQ designed to house 3,000 Coop employees, IT-related energy use and cooling is a major consideration. In order to keep energy consumption to a minimum, most of the processing power will be located in two rooms in the building's basement. Computers within the main office building will simply have a small box running on the main system rather than the usual 'tower'. The basement rooms will be cooled contain three circuit coolers running off the absorption chiller.

Waitrose's Energy Centres [29]

In March 2012, Waitrose unveiled its first Energy Centre at its store in East Cowes, making it the first UK supermarket to receive most of its heating, cooling and power from sustainably-sourced local woodchip.

Waitrose estimates that the Energy Centre will allow the shop to cut its carbon emissions by over 750 tonnes CO_2e per year. There will also be capacity in the future to heat local homes and community facilities.

Other features of the East Cowes store include propane-based refrigeration technology which reduces energy usage by 20% and a cold air-retrieval system instead of air-conditioning.

While Waitrose already sources around 97% of its electricity from 'on-grid' renewable sources, it plans to install up to 150 of its own renewable energy centres or equivalent means of generating renewable energy by 2020/21.

> *"We see no negative impact for the use of natural refrigerants. Waitrose and our supply chain continue to embrace natural refrigerants and do not feel that there are any blocks to moving forward."*
>
> Waitrose

Conclusion

What the future holds

This year's Chilling Facts survey has shown a wave of climate-friendly supermarket refrigeration spreading across Europe. To date Europe is leading the way in pioneering HFC-free refrigeration. Challenges in southern and eastern Europe remain, with relatively low participation in the survey and a lack of willingness to commit to going HFC-free. However progress made over the past few years is evidence that challenges can be met if retailers are willing to rise to them.

The retail industry is a globalised industry and corporate social responsibility should not end in Europe. With sluggish growth in Europe many retailers are basing their expansion plans on Asian markets such as China and Thailand where growth is currently at 7 and 10% respectively[30]. Three of the world's four leading retailers are located in Europe – Tesco, Carrefour and Metro – wielding considerable influence on the world stage. Carrefour holds an 8.1% market share in China's retail market[31], while Tesco has announced plans to double its number of hypermarkets in China to 200 by 2015[32].

EIA believes that commitments retailers make at home should be carried through entire estates across the globe. In many respects European retailers will set the pace for change in the rest of the world.

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**
- **The European Union should ban the use of HFCs in all new commercial refrigeration equipment by 2020**
- **Retailers should pay more attention to the development of HFC-free cooling in transport refrigeration and air-conditioning**
- **Retailers should agree to fit doors on all chilled food as standard**

Glossary

Term	Description	Global Warming Potential
Ammonia	A climate-friendly refrigerant used in some commercial refrigeration systems.	0
CO_2 Carbon Dioxide	A greenhouse gas used as the base measurement to compare the impact of other gases in terms of their global warming potential. It is also a climate-friendly alternative to HFCs.	1
CFCs Chlorofluorocarbons	One of a family of synthetic chemicals that were widely used in refrigeration, air conditioning, as aerosol propellants and for foam packaging, but were found to destroy the ozone layer – and so targets have been set to eliminate their use.	Up to 10,890
Climate-friendly refrigerants	EIA has used this term to refer to a group naturally occurring substances, such as ammonia, CO_2 and hydrocarbons, which are also known as natural refrigerants. They are used as alternatives to synthetic refrigerants such as HFCs, and CFCs.	Up to 5
CSR report	Corporate Social Responsibility report.	n/a
Global Warming Potential	How much effect a gas has compared to CO_2 in terms of its impact on global warming.	n/a
HCFCs Hydrochlorofluorocarbons	HCFCs are the class of refrigerant used prior to HFCs (see below); they have a high climate change impact and contribute to the destruction of the ozone layer. The use of 'virgin' HCFCs was banned in Europe from January 2010, but recycled HCFCs are still available and are used by some companies in old equipment.	Up to 2,310
Hydrocarbon	A climate-friendly refrigerant which has been used to replace CFCs in domestic refrigeration.	Up to 5
HFCs Hydrofluorocarbons	HFCs are a group of highly potent greenhouse gases commonly used in refrigeration and air conditioning. They are many thousands of times worse than CO_2 in terms of their impact. Worldwide, they are the fastest growing source of greenhouse gas emissions.	53 – 14,760
ODS Ozone Depleting Substances	These are any gases that play a part in depleting the ozone layer. The main culprits are CFCs but also HCFCs and some brominated substances, which are used as a fumigant, for example in strawberry growing.	Up to 10,890

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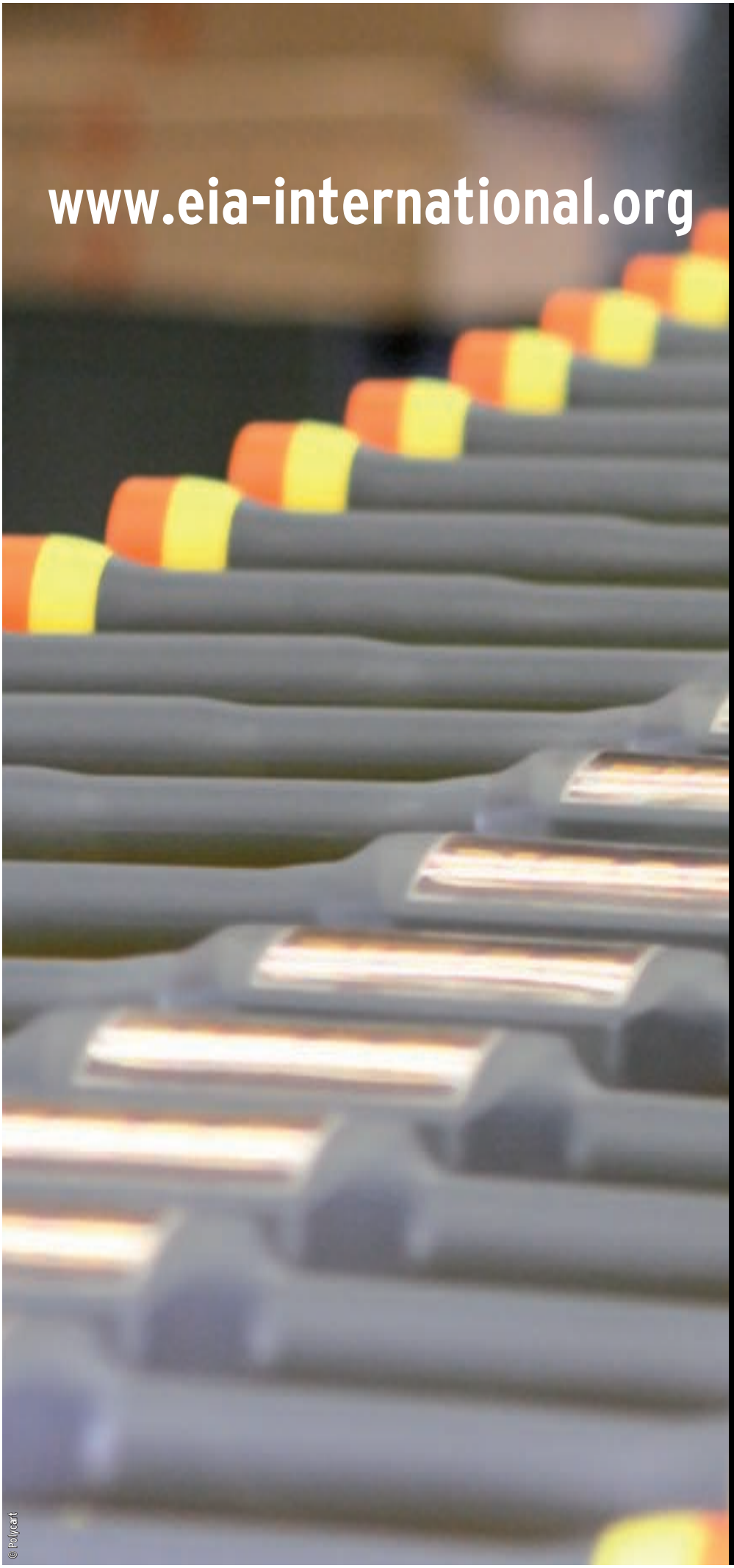

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