

BRIEFING

environmental investigation agency

CLIMATE

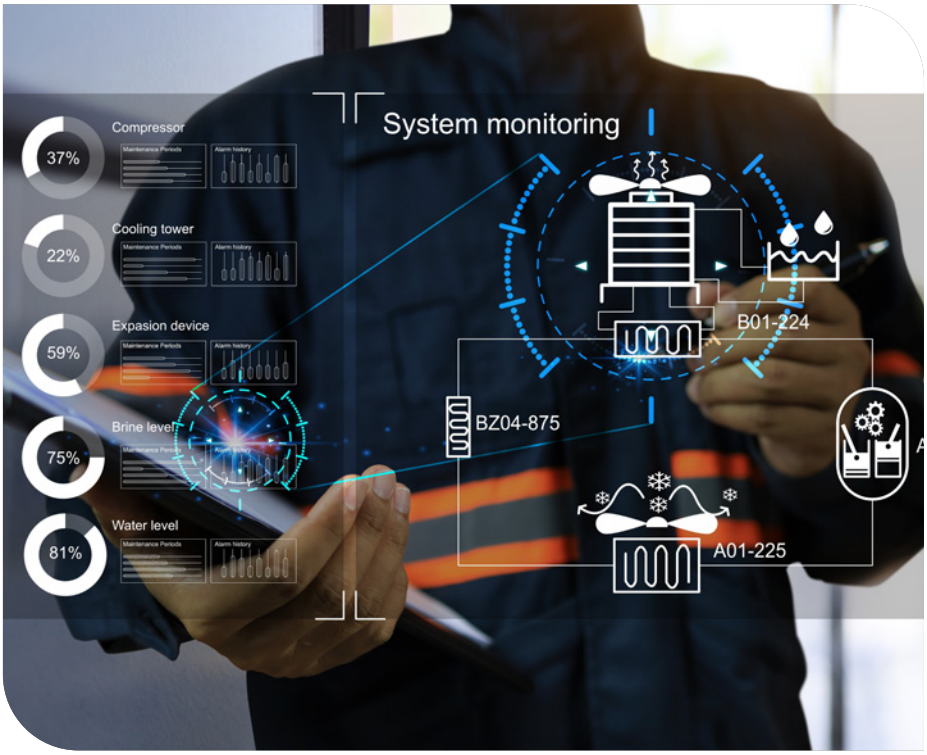
November 2026

FINANCING THE SUPERMARKET COOLING TRANSITION

The business case for sustainable cooling and the potential of Refrigeration-as-a-Service investment opportunities.

Powered by CDP

We are grateful to CDP for providing some of the data used in this report and for supporting our analysis of corporate progress on sustainable refrigeration.



SUMMARY

Supermarket refrigeration is critical infrastructure and ensuring it is resilient to future climatic and security challenges while concurrently reducing emissions is a major investment challenge and an opportunity for innovative finance.

Supermarket refrigeration is at a crossroads. While the sector continues to experience rapid global growth, driven by urbanisation and the expansion of supermarket networks, retailers face increasing pressure to decarbonise these highly polluting systems. Refrigeration already accounts for about seven per cent of global greenhouse gas emissions, a figure projected to double by 2030.

Refrigeration equipment failure, driven by extreme temperatures, escalating energy prices and an upcoming near-total phase-out of hydrofluorocarbon (HFC) refrigerants in the EU, is increasing pressure on retailers to replace ageing systems. Yet the upfront capital required to upgrade thousands of stores can slow investment, particularly across leased and franchised estates.

This report finds that sustainable cooling can generate significant operational savings for supermarkets while reducing exposure to rising refrigerant costs, regulatory risks and climate-related disruption. Analysis of retailer data shows reported annual savings equivalent to approximately 24 per cent of a retailer's investment in natural refrigerant systems, rising to an estimated 32-38 per cent when avoided F-gas refrigerant costs are included for two retailers.

The challenge is therefore increasingly one of financing rather than technology. Refrigeration-as-a-Service offers one potential solution, allowing a third party to finance, install and maintain secure cooling infrastructure while the retailer pays for the service over time. This report explores the financial case for sustainable cooling and asks what would be needed to scale these models across the supermarket sector.

Investment in sustainable cooling also offers benefits beyond emissions reductions and operational savings. As extreme temperatures become more frequent and intense, reliable and secure refrigeration is increasingly important to protecting food supply chains and strengthening climate resilience. Modern, energy-efficient systems using natural refrigerants can help supermarkets maintain reliable cooling under increasingly challenging conditions, while reducing exposure to volatile energy and refrigerant costs and the risk of illegal refrigerants in supply chains. Sustainable refrigeration should therefore be recognised as an investment in critical infrastructure, climate mitigation and adaptation.

Despite these opportunities expansion of supermarket cooling beyond the EU continues to rely on climate super pollutant HFC refrigerants, locking in long term emissions and risks associated with use of F-gas refrigerants.

Shifting the global supermarket sector towards resilient systems will require collaboration between retailers, financiers, technology providers and policymakers. Public finance and governments also have a key role to play both in developing supportive policies and reducing investment barriers through financial incentives.



RECOMMENDATIONS

SUPERMARKETS SHOULD MAKE SUSTAINABLE COOLING A STRATEGIC INVESTMENT PRIORITY.

Retailers should accelerate the replacement of ageing, HFC refrigeration systems with energy-efficient, natural refrigerant alternatives. Investment decisions should account for the full financial benefits of sustainable cooling, including reduced energy consumption, avoided refrigerant costs, lower exposure to regulatory penalties and improved resilience to extreme temperatures.

FINANCIERS SHOULD RECOGNISE SUSTAINABLE REFRIGERATION AS AN INVESTABLE INFRASTRUCTURE OPPORTUNITY.

Institutional investors, infrastructure funds, banks and other providers of transition finance should explore opportunities to finance supermarket refrigeration upgrades. Financing models should recognise the long-term value of these assets and their potential to generate predictable returns.

SCALE REFRIGERATION-AS-A-SERVICE THROUGH PARTNERSHIPS BETWEEN INVESTORS, RETAILERS AND TECHNOLOGY PROVIDERS.

Investors, supermarket chains, equipment manufacturers and service companies should work together to expand Refrigeration-as-a-Service and other innovative financing models. These partnerships can combine investment capital, technical expertise and long-term service contracts to overcome upfront capital barriers.

POLICYMAKERS SHOULD HELP CREATE THE CONDITIONS FOR INVESTMENT IN SUSTAINABLE COOLING.

Governments should recognise sustainable cooling as an important contributor to climate targets, energy efficiency and climate resilience, and use financial incentives to accelerate investment. This should be underpinned by clear regulatory signals, including restrictions on the use of F-gases in new equipment, to ensure that investment is directed towards future-proof, natural refrigerant technologies rather than locking in further dependence on climate- and environment-polluting refrigerants.



F-gas free sustainable supermarket refrigeration is major investment opportunity hiding in plain sight.

THE INVESTMENT OPPORTUNITY

Extreme temperatures driven by climate change alongside recent cyberattacks on supermarket refrigeration systems have brought to light the critical role supermarkets play in global food supply chains and the need to urgently invest in future-proof systems.

Prolonged and repeated heatwaves across Europe this summer resulted in widespread failures of cooling systems, while more recently cyberattacks, which turned up the temperature on supermarket refrigeration systems, spoiled large amounts of food and resulted in significant financial losses, with one French chain, Intermarché, reporting losses of tens of millions of euros in a single day.[1]

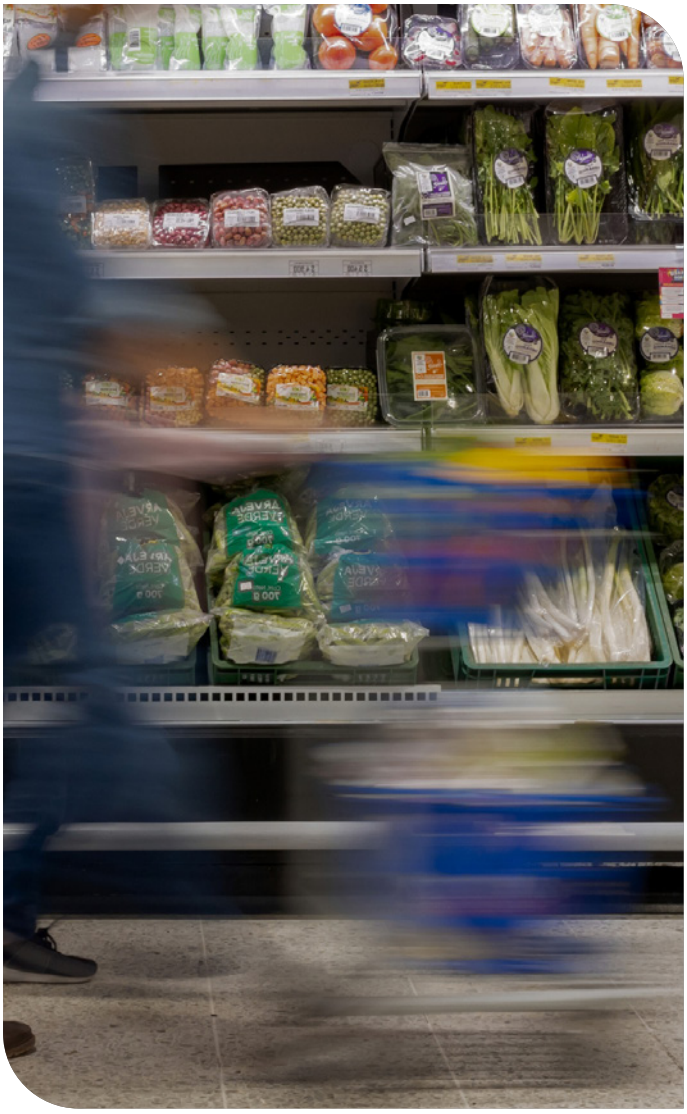
As global supermarket networks expand, retailers face growing pressure to decarbonise their systems. Refrigeration accounts for about seven per cent of global greenhouse gas emissions,[2] with emissions from the food retail sector estimated to be about 320 million tonnes carbon dioxide equivalence (CO_2e) in 2022.[3]

As retailers across Europe and beyond consider how best to invest in refrigeration systems fit for a changing world, they have an opportunity to strengthen resilience through low-emission cooling which reduces energy use and refrigerant costs, withstands extreme temperatures and anticipates future regulatory changes.

Supermarket refrigeration is a key contributor to retailers' Scope 1 and 2 emissions.[4] A 2025 analysis by the Environmental Investigation Agency (EIA) of five major retailers found that emissions from cooling contributed to between 40-70 per cent of Scope 1 and 2 emissions, with leaking high global warming potential (GWP) HFC refrigerants accounting for about half of that impact, the other half resulting from energy-related emissions.[5]

In the European Union (EU), the F-Gas Regulation is driving a rapid phase-out of hydrofluorocarbons (HFCs), with a 95 per cent reduction in the carbon weighted allocation of HFC quota scheduled for 2030.[6] Yet, in 2025, only about 34 per cent of European supermarket stores had transitioned to F-gas-free sustainable alternatives.[7]

With the availability of HFCs set to decline sharply, remaining stores will need to rapidly transition, creating a substantial requirement for investment in new and upgraded sustainable cooling infrastructure. Retailers which continue to rely on F-gas refrigerants also face increasing risks of illegal trade within their supply



chain, as evidenced by EIA investigations which raised concerns that illegal refrigerants may be entering supermarket supply chains.[8]

Furthermore, many F-gases are considered to be, or break down into, per- and polyfluoroalkyl substances (PFAS), also known as 'forever chemicals' as they are highly persistent in the environment. The European Commission is currently considering a proposal for an EU restriction on all substances classified as PFAS.[9]

Regulatory pressure to move away from F-gases extends beyond Europe via a global phase-down of HFCs under the Kigali Amendment to the Montreal Protocol, which will need to be accelerated, as scientists have warned that the current pathway is insufficient to limit warming to 1.5°C.[10]

The technology needed to make this transition is already available and increasingly established. The dominant technology for centralised supermarket systems uses CO_2 as a refrigerant in transcritical systems. CO_2 is a natural refrigerant with very low climate impact compared with HFCs.

The business case for sustainable cooling is increasingly strong. This analysis of reported retailer data indicates that annual savings associated with the reduced energy consumption of natural refrigerant systems average approximately 24 per cent of annual investment. For the two retailers with sufficient data to estimate avoided F-gas refrigerant costs, combining these costs with energy-related savings increases estimated annual savings to about 32-38 per cent of annual investment. These figures are indicative rather than store-level returns, but they demonstrate the potential for sustainable cooling to deliver meaningful financial value alongside emissions reductions.

The investment case is likely to strengthen as the availability of F-gas refrigerants dwindles under the EU HFC phase-out. European distributor prices for a high GWP F-gas refrigerant commonly used in supermarkets have risen by about 1,400 per cent since the phase-out began in 2014.[11] As Europe faces a significant HFC quota reduction in 2027, prices are likely to further escalate alongside risks of non-quota compliant HFCs in cooling supply chains.

Fortunately, information shared by retailers using natural refrigerant systems demonstrates significant operational savings and resilience to rising temperatures, proving that investment in modern, sustainable and efficient systems can provide benefits that extend beyond emissions reductions.

However, the relatively slow pace of sustainable cooling roll-out across Europe's supermarket sector suggests the challenge is increasingly one of financing rather than technology. Retailers must generally fund the investment upfront, while the financial benefits accrue over the lifetime of the equipment. This can make investment more difficult where capital is constrained, where store ownership is uncertain or where leases and franchise arrangements shorten the period over which a retailer expects to benefit from an investment.

This creates an opportunity for new financing and business models. Cooling-as-a-Service is one potential approach, allowing a third party to finance, install, operate and maintain cooling equipment while the retailer pays for cooling as an ongoing service. By shifting expenditure from upfront capital investment towards a predictable service payment, such models could enable retailers to access secure, efficient, F-gas-free cooling without carrying the full initial investment on their balance sheet.

A growing market for such models could also create opportunities for financiers, energy companies, equipment providers and specialist cooling businesses. The potential is not simply to finance individual refrigeration upgrades, but to develop scalable models that can aggregate projects across multiple stores and provide predictable, performance-linked returns.

This report examines retailer data reported publicly and to the Carbon Disclosure Project (CDP) in order to develop a financial analysis of sustainable cooling and explores how models such as Cooling-as-a-Service could help unlock investment across the supermarket sector.

Above: F-gas free cooling can deliver climate benefits, operational savings and more resilient food supply chains.

THE BUSINESS AND CLIMATE CASE FOR SUSTAINABLE COOLING

The use of F-gas refrigerants is a major source of retailer emissions, accounting for about half a retailer's reported Scope 1 and 2 emissions.[12] Switching to natural refrigerant based cooling is therefore a key lever in meeting climate emission reduction targets. Fortunately, it also presents a range of other benefits.

International retailer, Jerónimo Martins, estimated emission reductions of 12.7 per cent in a single year, from 2023-24 due to a combination of reductions in emissions of high-GWP refrigerants (through their replacement with natural refrigerants) and from energy efficiency measures.[13] Similarly another global retailer reported to CDP that emissions linked to the use of refrigerants have fallen by 26 per cent compared with 2019.[14]

SAVINGS FROM ENERGY COSTS

Sustainable cooling systems are proving to have significant financial benefits as well. Table 1 shows reported annual investment in natural refrigerant systems alongside financial savings associated with adoption of natural refrigerants for three major retailers: Ahold Delhaize, Carrefour and Jerónimo Martins. Carrefour reported the highest energy related financial savings to investment in natural refrigerants percentage, at 34 per cent. Ahold Delhaize's Belgian stores reported the lowest savings to investment percentage, at two per cent. The retailer noted that Belgian operations were in the process of transitioning some stores to a franchise model, which can influence how savings are reported relative to investment.

According to the retailer data analysed, annual returns equate on average to about 24 per cent of investment in natural refrigerant systems. That means that for every €1 million invested in natural refrigerant systems, the retailer benefits from around €240,000 in annual energy savings before considering avoided refrigerant costs (see Table 1 and Figure 1).

Although the data presented here is aggregated at company or country level, it aligns well with Carrefour's and Jerónimo Martins' reported pay back periods of about 4-10 years for natural refrigerant systems.[15] Given refrigeration system lifetimes of about 15 years, these investments are financially compelling.[16]

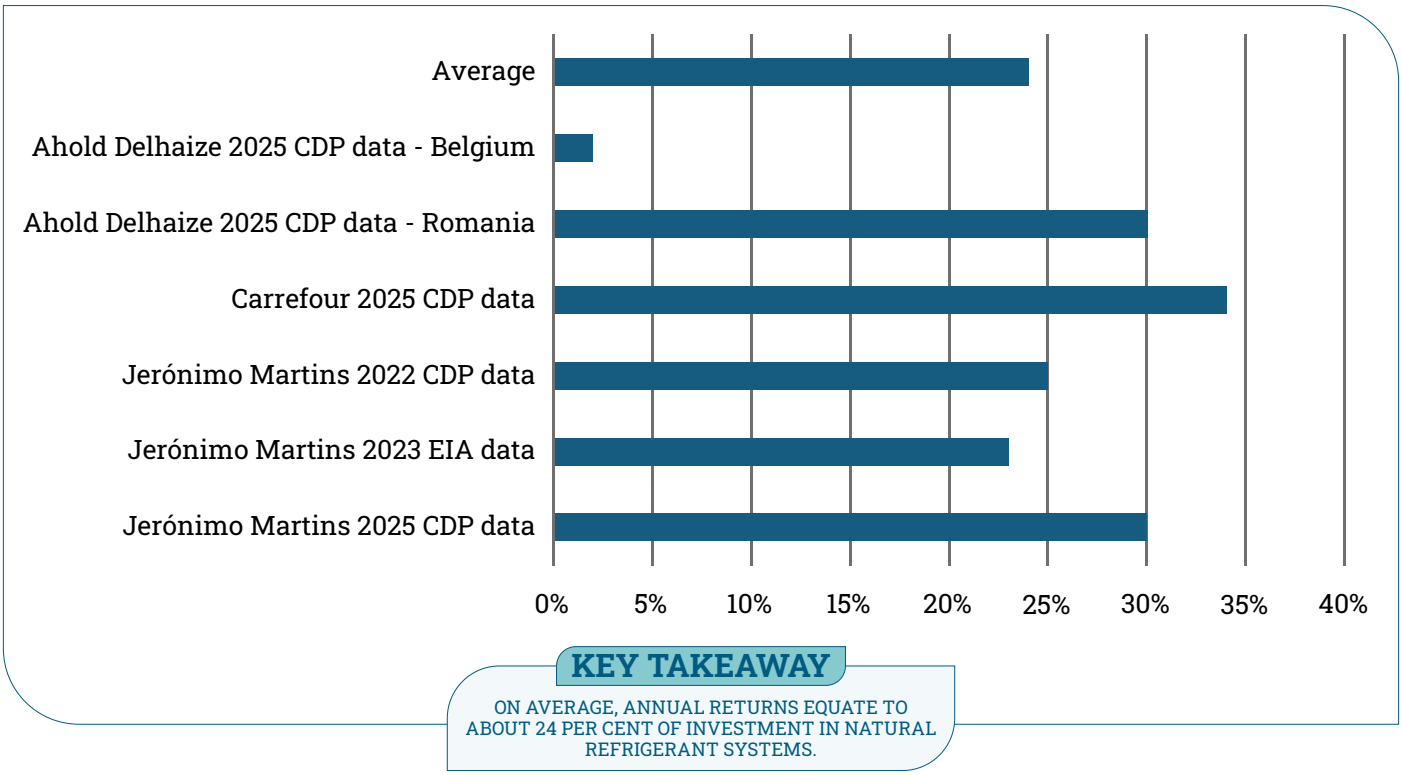
It should be noted that the above data does not include significant additional energy savings associated with doors on fridges as retailers tend to report on this separately to other measures.

***Table 1:** Analysis of the costs and pay backs of adoption of natural refrigerant cooling systems* [17]

Company	Annual investment in natural refrigerant systems (€)	Annual energy savings (€)	Annual energy savings as a % of investments in natural refrigerants
Jerónimo Martins 2025 CDP data	90,009,800	26,897,600	30%
Jerónimo Martins 2023 EIA data	91,000,000	20,600,000	23%
Jerónimo Martins 2022 CDP data	60,200,000	14,800,000	25%
Carrefour 2025 CDP data	Not publicly available	Not publicly available	34%
Ahold Delhaize 2025 CDP data Romania*	3,180,000	966,635	30%
Ahold Delhaize 2025 CDP data-Belgium*	1,750,000	30,000	2%
Average			24%

**Ahold Delhaize has reported on a regional basis. US data was excluded as no cost savings data was available. Ahold Delhaize noted that this may be because the data is not yet being collected.*

Figure 1: *Annual energy savings as a percentage of investments in natural refrigerants as reported by three retailers*



SAVINGS FROM EXPENSIVE REFRIGERANTS

F-gas refrigerants have added significant operational costs for retailers, as centralised supermarket refrigeration systems are prone to high leakage rates, resulting in significant emissions. For example, retailer Carrefour reported an annual leakage rate of 20 per cent in 2022, meaning that on average systems lost 20 per cent of their refrigerant load each year.[18] F-gas leakage not only contributes to emissions, but requires refrigeration systems to be topped up with additional refrigerants, the cost of which can run into thousands of euros per store.

Table 2 estimates hypothetical F-gas refrigerant annual refill costs per store for Jerónimo Martins, Carrefour and stores with very large sales areas. These costs are impacted by the sales area of the store and the subsequent amount of refrigerant needed for the system to cool it, known as the charge size. Full details of the assumptions used to estimate annual costs can be found in Appendix 1.

Although sales areas of stores vary, data on average sales areas for each retailer was used in the estimation. Commonly used refrigerants include R404A, which has a GWP of 3,988, and R449A, which has a GWP of 1,397. Although the use of virgin R404A to service systems is now banned in the EU, ongoing use of recycled and reclaimed R404A is currently legal. The findings in Table 2 indicate that annual F-gas refill costs can vary between €2,085-21,600 per store.

Table 2: *Potential avoided F-gas refrigerant refill costs per store*

Supermarket	Typical sales Area (m²)*	Amount of refrigerant used in a supermarket system- Charge size (kg)*	Leak rate	R449A annual cost per store (€)	Reclaimed R404A annual cost per store (€)
Jerónimo Martins	1,188	321	10%	2,085	2,566
Carrefour	6,300	1,701	10%	11,057	13,608
Very large format store	10,000	2,700	10%	17,550	21,600

**See Appendix 1 for assumptions.*

Table 3 goes on to estimate the annual savings in avoided F-gas refill costs for Jerónimo Martins and Carrefour, based on the number of stores they reported as covered by natural refrigerant investments in their 2025 CDP disclosures. The annual refill costs of the natural refrigerant alternatives are not deducted from the savings due to avoided F-gases for two reasons. Systems using natural refrigerants must be leak tight for safety reasons. Secondly the refrigerants themselves may be significantly cheaper. According to European Commission estimates CO_2 (R744) refrigerant costs approximately €5/kg.[19]

Store based estimated avoided refrigerant costs (based on use of R449A) for Jerónimo Martins and Carrefour were applied to the number of stores reportedly incorporated in the retailers' annual investment in natural refrigerants in order to calculate further potential operational savings, in addition to those already reported due to energy savings. These are documented in Table 3 and indicate that inclusion of avoided refrigerant costs could increase annual savings to about 32-38 per cent of investment.

This should be treated as an illustrative estimate only as it is dependent on assumptions around refrigerant prices, system charge sizes and leakage rates. It is also worth noting that the calculation is based on 2026 refrigerant prices. With the EU supply of F-gases due to tighten further in 2027, refrigerant prices are likely to rise, increasing the value of avoided F-gas top-up costs over time.

Table 3: *Estimated avoided annual F-gas refill costs for Jerónimo Martins and Carrefour*

Company	Annual investment in natural refrigerant systems (€)	Annual energy savings (€)	Number of stores covered by investment in natural refrigerants	Avoided F-gas (R449A) refrigerant costs (€)	Annual Energy and avoided F-gas refrigerant cost savings as a % of investment
Jerónimo Martins 2025 CDP data	90,009,800	26,897,600	702	1,464,723	32%
Carrefour 2025 CDP data	Not publicly available	Not publicly available	300	3,316,950	38%

SAVINGS FROM AVOIDED FINES

In its financial risk reporting to CDP, one retailer has estimated that stores using F-gases may be subject to fines of up to €75,000 per store under the EU F-Gas Regulation, estimating a short-term risk on cash flow of between €20-30 million.

Under the EU F-Gas Regulation, penalties for unlawful use of F-gases should be at least five times the market value of the gas.[20] Recent investigations by EIA have documented the prevalent practice of mislabelling illegally imported high GWP refrigerants as 'reclaimed' in order to circumvent use restrictions.[21] Using figures from Table 2, a store with 6,300 m² is expected to use about 1,700kg of refrigerant. Based on an €80/kg price for reclaimed R404A,[22] the value of the gas in the system could be up to €136,000. In a case where all the gas was considered to be unlawful, a retailer could face a fine of €680,000 for that store.

This is just an illustrative example and is not included in the broader savings analysis, but fines under the F-Gas Regulation are enough of a serious threat to capital, that one retailer has included it as a financial risk in its CDP reporting.

As public awareness around the use of sustainable cooling grows, brands which continue to rely on F-gases or fail to comply with F-gas Regulations could also risk reputational damage. Combined with F-gas penalties, one retailer reported to CDP that loss of consumer confidence due to absence of low carbon equipment and penalties for poor energy management could cost the company up to €30 million in the short term.[23]

Future regulatory exposure under the EU Corporate Sustainability Due Diligence Directive may also be relevant. From July 2028, certain large EU and non-EU companies operating in the EU will be required to demonstrate that they have adopted a 1.5°C aligned transition plan and penalties may be significant, with fines of up to five per cent of global turnover allowed under the Directive.[24] However, these potential penalties are not included in this analysis as their application to supermarket cooling related emissions would depend on a range of legal and other considerations.


©Sorbis / Shutterstock.com

RESILIENT REFRIGERANTS

As global warming worsens, supermarkets will feel the brunt of climate-related effects. Ongoing European heatwaves have highlighted the need to update supermarket refrigeration systems, with older systems being more prone to failures.[25]

Jerónimo Martins is candid in its assessment of the impact of global warming on its cooling systems. In its 2025 CDP report, the company notes that increasing frequency and intensity of heatwaves is a significant risk to capital costs, due to replacement of cooling equipment suffering under the increasing stress of a warming environment and increased costs of running older, less efficient refrigeration systems. It estimates that up to €241 million of capital will be needed to replace failed systems and up to €5 million to cope with higher operating costs in a warmer climate.[26]

Fortunately, evidence from retailers suggests that CO_2 systems are proving resilient to extreme temperatures. METRO AG reports that stores running on CO_2 are dealing with temperatures above 40°C.[27] Additionally, Ahold Delhaize has noted that CO_2 systems in Greece and Romania have coped well, even at temperatures of up to 45°C, reinforcing that CO_2 installations are future proof solutions, both environmentally and in terms of energy consumption.

Above: Modern systems using natural refrigerants are coping with extreme temperatures



THE CAPITAL BARRIER

Despite the mounting case for a rapid transition to sustainable cooling, European retailers still have a long way to go in order to fully phase out F-gases.[28]

Even with attractive returns on investment, the capital required to invest in sustainable cooling systems could remain a significant barrier to uptake. For example, in its 2025 sustainability report, Ahold Delhaize notes that investing in more sustainable refrigeration systems may require reallocating capital which could otherwise be directed to other operational growth priorities.[29]

A shift towards franchise business models by some retailers to help reduce capital and operational costs can also impact investment. For example, 80 per cent of Carrefour's French stores are either franchised or under lease management models.[30] By contrast, companies leading the transition in sustainable cooling, such as Jerónimo Martins and METRO AG, do not rely on franchise models in the same way, possibly allowing them to invest more capital in sustainable cooling.

This is supported by EIA's 2025 analysis which found leading retailers Jerónimo Martins and Metro AG allocating a higher proportion of capital expenditure towards investment in low-GWP refrigerants than other retailers analysed.[31] Franchised stores may be more reluctant to invest in measures with longer pay back periods as there can be uncertainty over the length of the store lease or have less access to finance and well-resourced sustainability initiatives.

Given the apparent role that store ownership and capital access may play in the adoption of sustainable cooling, new financial models such as Refrigeration-as-a-Service could help accelerate uptake.

Above: The technology exists. Why is the transition too slow? Upfront capital costs remain a major barrier to supermarket investment in natural refrigerants.

REFRIGERATION-AS-A-SERVICE

Traditional supermarket refrigeration investment requires retailers to commit substantial capital upfront. Refrigeration-as-a-Service offers an alternative approach whereby third parties finance and manage the equipment while the retailer pays for cooling as an ongoing service.

CASE STUDY: ANEO RETAIL NORWAY

Aneo Retail is a Nordic energy company which provides sustainable, fully managed technical systems to grocery stores and supermarkets.[32]

Aneo Retail has developed a Refrigeration-as-a-Service model allowing grocery stores to access modern, energy-efficient, F-gas-free equipment through a subscription arrangement, reducing the need for large upfront investment. The offer includes performance commitments relating to energy efficiency, reliability and operating costs, helping to provide more predictable expenditure.

Under the model, Aneo Retail covers the upfront investment in cooling equipment and charges the end user an annual fee which contributes to recovery of the system cost while also covering comprehensive servicing and detailed energy monitoring.

Momentum is building for this approach. On 28 October 2026, White Summit Capital, an energy transition infrastructure investor, announced an investment of up to €100 million in Aneo Retail, alongside Danfoss, to support the expansion of its Refrigeration-as-a-Service model into new markets.[33] The involvement of a major supplier of refrigeration technologies highlights the potential for collaboration between investors and established industry players to scale new financing models. Similarly, major cooling equipment producer, Carrier, has just launched a pilot Refrigeration-as-a-Service initiative.[34]

Investments often cover a full store retrofit, including doors on refrigerated cabinets. As a result, the examples shown in Table 4 deliver reported annual energy savings of between 27-45 per cent of annual service costs. Aneo Retail has indicated that about 70 per cent of these energy savings come from the upgraded system using natural refrigerants, with the remaining 30 per cent of reported energy savings resulting from doors on refrigerated cabinets.

"Refrigeration-as-a-Service goes beyond equipment financing, enabling grocery chains to modernise, standardise and professionalise infrastructure across diverse store models. Its 10-15 year contracts align financing, asset lifetime and operations for predictable, long-term stability across both central and decentralised portfolios. However, bankability hinges on robust contract structures, creditworthiness and secure cash flows, not just technical merit."

KJETIL LARSEN
CEO of Aneo Retail

***Table 4:** Aneo Retail Refrigeration-as-a-Service retail financial feasibility analysis.*[35]

	Example 1	Example 2	Example 3
Initial ANEO retail investment (€)	1,008,583	565,000	278,000
Annual user service cost, based on a 10-year contract (€)	235,130	108,000	56,000
Annual energy savings (€)	103,005	48,400	15,000
Energy savings as a percentage of user costs	44%	45%	27%
Simple payback period based on energy savings only (years)	10	12	19



The data presents three examples of installations of different sizes. The simple payback calculation divides the initial Aneo Retail investment by annual energy savings in order to estimate the number of years required for the system to pay for itself through energy savings alone. On that basis, the examples indicate simple payback periods of about 10-19 years. Avoided F-gas refrigerant costs are not included in this analysis, but its inclusion would reduce these pay-back periods.

Examples 2 and 3 are longer than the indicative 4-10 year range reported by Carrefour and Jerónimo Martins, which may reflect differences in project scope. Even so, the analysis highlights the value of the Refrigeration-as-a-Service model in this sector as it can help retailers avoid large upfront capital expenditure and manage investment even where payback periods are longer.

Above: What if supermarkets didn't have to pay upfront? Refrigeration-as-a-Service is a potential win-win for retailers and infrastructure. investors.

HOW REFRIGERATION-AS-A-SERVICE WORKS[36]

1. WHO OWNS THE ASSET?

The financier or service provider owns refrigeration equipment over its lifetime

2. WHO TAKES PERFORMANCE RISK?

Contracts guarantee energy efficiency, reliability and maintenance

3. HOW ARE SAVINGS SHARED?

Energy savings and avoided refrigerant costs benefit the retailer who pays service and maintenance fees to the Refrigeration-as-a-Service provider.

4. HOW DO CONTRACTS WORK FOR LEASED AND FRANCHISED STORES?

Service contracts serve both retailers with centrally owned store portfolios and chains operating through franchisees or independent store owners. Contracts are often 10-15 years, requiring clear terms on credit, payments, equipment ownership and operational changes to ensure financial sustainability.

5. WHAT DATA DO FINANCIERS NEED?

Financiers require standardised technical, operational and financial information – including energy use, performance, maintenance, creditworthiness, cash flows and risk allocation – to evaluate project profitability and risk.

Standardised metrics and contracts streamline individual assessments and allow central or franchised stores to be aggregated into investment portfolios.

6. CAN PROJECTS BE AGGREGATED?

Rather than financing individual supermarket upgrades, portfolios of stores can be bundled into larger infrastructure or energy-efficiency investments



It's time to invest in the supermarket cooling transition.

CONCLUSION: FROM CLIMATE INVESTMENT TO INVESTABLE INFRASTRUCTURE

The case for modernising supermarket refrigeration extends beyond emissions reductions and operational savings. As climate change increases the frequency and intensity of extreme heat, reliable and secure cooling is becoming increasingly important to the resilience of food supply chains.

Supermarket refrigeration is critical infrastructure, yet ageing and inefficient systems can be vulnerable to rising temperatures, cyberattacks, equipment failure, volatile refrigerant prices and increasing energy demand. Investment in modern, energy-efficient systems using natural refrigerants can help retailers manage these risks while reducing their contribution to climate change.

However, the scale of investment required means the sector cannot rely solely on retailers' balance sheets. New approaches to financing could help unlock upgrades which might otherwise be delayed, particularly across leased and franchised estates. Refrigeration-as-a-Service provides one potential solution. By shifting investment in cooling equipment from upfront capital expenditure towards an ongoing service payment, it allows retailers to access efficient, F-gas-free infrastructure while transferring some of the financing, maintenance and performance responsibilities to specialised providers.

Although ambitious regulations are driving the shift in Europe, the roll out of F-gas free sustainable cooling is a global opportunity to invest in both climate mitigation and adaptation. Recognising cooling as essential infrastructure for food security and economic resilience could broaden the pool of potential investors. Development banks and public finance could support the transition.

Beyond finance, governments have a key role to play in developing regulations which recognise sustainable cooling as an important contributor to climate targets, energy efficiency and climate resilience. These should include restrictions on the use of F-gases in new equipment, to help ensure that investment is directed towards future-proof, natural refrigerant technologies rather than locking in further dependence on climate-polluting risky refrigerants.

APPENDIX 1:

BACKGROUND ASSUMPTIONS FOR TABLE 2: POTENTIAL AVOIDED F-GAS REFRIGERANT COSTS PER STORE

The avoided costs were calculated using industry price data of about €80/kg for reclaimed and about €65/kg for R449A.[37] A fixed annual leakage rate of 10 per cent is assumed for all systems. In practice, leakage rates may vary significantly depending on system age, maintenance quality and design standards and may exceed this value in some cases.

Total refrigerant charge per store is estimated using an intensity factor of 0.27 kg/m² of sales area, as referenced in the European Commission F-Gas Regulation impact assessment.[38] Store size varies substantially across European supermarket formats and retailers. For example, Jerónimo Martins' Pingo Doce stores in Portugal average approximately 1,188 m² of sales area.[39] In contrast, large-format hypermarkets in Europe typically range from 3,000-10,000 m².[40] For Carrefour, an average store sales area of 6,300 m² is used, consistent with reported average hypermarket sizes in its Brazilian stores.[41]

References

1. Leicester (2026) 'French cybersecurity authority warns attack may be ongoing as stores scramble to restock' News article, 14 October 2026. Available here: https://apnews.com/article/france-supermarkets-hacked-cybercrime-81c2d5721f4df77f601f71741ef7c291
2. Centre for Sustainable Cooling (2022) Sustainable and Resilient Cold-Chains: The 2050 Imperative. p. 9. Available here: https://www.sustainablecooling.org/wp-content/uploads/2023/08/The-Local-to-Global-Summit-Report.pdf
3. Flammini et al (2024) 'Greenhouse Gas Emissions from Cold Chains in Agrifood Systems' Sustainability 2024 16(21). Available here: https://www.mdpi.com/2071-1050/16/21/9184
4. EIA (2025) Cooling the Climate Crisis: Why investing in sustainable refrigeration is crucial for decarbonising supermarkets. Available here: https://eia-international.org/report/cooling-the-climate-crisis/
5. EIA (2025) Cooling the Climate Crisis: Why investing in sustainable refrigeration is crucial for decarbonising supermarkets. Available here: https://eia-international.org/report/cooling-the-climate-crisis/
6. Regulation (EU) 2024/573 of the European Parliament and of the Council of 7 February 2024 on fluorinated greenhouse gases
7. ATMO (2026) Refrigeration: Commercial and Industrial refrigeration with Natural Refrigerants. Available here: https://intelligence.atmosphere.cool/reports/legacy/refrigeration-commercial-and-industrial-refrigeration-with-natural-refrigerants-2025
8. EIA (2026) 'Fakes, Fraud and F-gases: How the illegal trade in HFC super-pollutants threatens climate targets and corporate supply chains' Available here: https://eia-international.org/report/fakes-frauds-and-f-gases/
9. ECHA, 2026. Minutes of the 77th Meeting of the Committee for Risk Assessment (RAC-77). Available here: https://www.actu-environnement.com/media/pdf/depeches/1131.pdf
10. Climate and Clean Air Coalition (CCAC). 2021. Opportunities for 1.5˚C Consistent HFC Mitigation. Available at: ccacoalition.org/sites/default/files/resources//SPD2020%20-%20HFC%20Opportunities%20-%20Key%20Messages%20-%202021Update.pdf?__cf_chl_tk=ru1rQIrQyYnBCAO.TF2RT4NIeOrTdaNznoVfW0eWKcY-1791973959-1.0.1.1-xl0598JrMCmq.frGgnCBvmyYQyzJR_h7DGzy3z1MIRM
11. European Commission (2026) 'Monitoring of Refrigerant Prices on the EU market in light of the HFC quota system put in place by Regulation (EU) 2024/573 Results of Quarterly Survey: Quarter 1/2026' Available here: https://climate.ec.europa.eu/document/download/952b01fd-5eae-4ac5-b073-76c7056411c9_en?filename=Price%20monitoring%20Q1%202026.pdf
12. EIA (2025) Cooling the Climate Crisis: Why investing in sustainable refrigeration is crucial for decarbonising supermarkets. Available here: https://eia-international.org/report/cooling-the-climate-crisis/
13. Jerónimo Martins 2025 CDP Climate Disclosure, page 198. Available here: https://www.Jerónimomartins.com/wp-content/uploads/01-DOCUMENTS/Responsibility/Environment/EN/2025_CDP_Integrated_Questionnaire_JM.pdf
14. Restricted CDP Climate Disclosure information.
15. Jerónimo Martins and Carrefour 2025 CDP Climate Disclosures
16. (2023) Christoph Brouwers: "The market penetration of CO_2 technology will definitely continue in many refrigeration applications in the future." Available at: https://www.euroshop tradefair.com/en/Media_News/EuroShop_mag/Especially_in_the_field_of_%E2%80%8B%E2%80%8Bsupermarket_refrigeration_there_lies_significant_saving_potential
17. Sources include CDP data and data shared with EIA by retailers. Ahold Delhaize 2025 CDP Climate Disclosure Available here: https://media.aholddelhaize.com/media/pokpyvdl/cdp-corporate-questionnaire-2025.pdf

    Jerónimo Martins 2025 CDP Climate Disclosure. Available here: https://www.Jerónimomartins.com/wp-content/uploads/01-DOCUMENTS/Responsibility/Environment/EN/2025_CDP_Integrated_Questionnaire_JM.pdf
18. Carrefour (2023) Carrefour Group Climate Plan. Available here: https://www.carrefour.com/sites/default/files/2023-07/ Carrefour%2023%20-%20PLAN%20CLIMAT%20-%20EN%20-%20 003.pdf
19. European Commission (2026) 'Monitoring of Refrigerant Prices on the EU market in light of the HFC quota system put in place by Regulation (EU) 2024/573 Results of Quarterly Survey: Quarter 1/2026' Available here: https://climate.ec.europa.eu/document/download/952b01fd-5eae-4ac5-b073-76c7056411c9_en?filename=Price%20monitoring%20Q1%202026.pdf
20. Article 31, Regulation (EU) 2024/573 of the European Parliament and of the Council of 7 February 2024 on fluorinated greenhouse gases
21. EIA (2026) 'Fakes, Fraud and F-gases: How the illegal trade in HFC super pollutants threatens climate targets and corporate supply chains' Available here: https://eia-international.org/report/fakes-frauds-and-f-gases/
22. European Commission (2026) 'Monitoring of Refrigerant Prices on the EU market in light of the HFC quota system put in place by Regulation (EU) 2024/573 Results of Quarterly Survey: Quarter 1/2026' Available here: https://climate.ec.europa.eu/document/download/952b01fd-5eae-4ac5-b073-76c7056411c9_en?filename=Price%20monitoring%20Q1%202026.pdf

23. Restricted CDP Climate Disclosure information.

24. European Union Directive 2024/1760. Article 27. Available here: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202401760

25. Harvey (2026) 'Old British fridges 'cannot cope with the heat' News Item 2 July 2026. Available here: https://www.bbc.co.uk/news/articles/c77yejxnvpxo

26. Jerónimo Martins 2025 CDP report, page 52

27. Pers Comm METRO AG Head of Energy

28. EIA (2025) Cooling the Climate Crisis: Why investing in sustainable refrigeration is crucial for decarbonising supermarkets. Available here: https://eia-international.org/report/cooling-the-climate-crisis/

29. Ahold Delhaize (2025) 'Sustainability statements - annual report 2025' Available here: https://aholddelhaize.com/digitalannualreport/2025/documents/Sustainability-statements---annual-report-2025.pdf

30. Van Rompaey (2026) 'Carrefour offloads dozens of hypermarkets and supermarkets in France' News Item 13.04.26 Available here: https://www.retaildetail.eu/news/food/carrefour-is-once-again-spinning-off-dozens-of-hypermarkets-and-supermarkets-in-france/

31. EIA (2025) Cooling the Climate Crisis: Why investing in sustainable refrigeration is crucial for decarbonising supermarkets. Available here: https://eia-international.org/report/cooling-the-climate-crisis/

32. Pers Comms Kjetil Larsen, CEO of Aneo Retail

33. White Summit Capital (2026) 'White Summit Capital to invest up to €100m in Aneo Retail, alongside Danfoss, to scale refrigeration-as-a-service for European food retailers' News item 28 October 2026. Available here: https://whitesummitcap.com/white-summit-capital-to-invest-up-to-e100m-in-aneo-retail-alongside-danfoss-to-scale-refrigeration-as-a-service-for-european-food-retailers/

34. Carrier (2026) Available here: https://www.carrier.com/commercial-refrigeration/en/uk/solutions/refrigeration-as-a-service/

35. Pers Comms Kjetil Larsen, CEO of Aneo Retail

36. Pers Comms Kjetil Larsen, CEO of Aneo Retail

37. R449A price data: European Commission (2026) 'Quarterly Quota Price Monitoring' Quarter 1/2026 Service level prices: Available here: https://climate.ec.europa.eu/areas-action/fluorinated-greenhouse-gases/documentation/reports_en Reclaimed R404A price data is not shared by the European Commission, and is therefore based on estimates from discussion with industry.

38. Preparatory study for a review of Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases. Annexes to the Final Report. Page 110. Available here: https://www.consultations-publiques.developpement-durable.gouv.fr/IMG/pdf/etude_preparatoire_pour_la_revue_du_reg_fgaz-annexes.pdf

39. Data derived from total 2025 Pingo Dolce sales area of 590,565 m² across 497 stores. Available here: https://www.jeronimomartins.com/en/investors/jm-in-numbers/performance-business-unit-5-years/#1505502691975-83d2efa6-2b0b7e32-7390

40. EuroCommerce (2001) The Value of European Retail-A Factbook Available here: https://www.eurocommerce.eu/app/uploads/2022/08/2021_05_20-VERF-Full-FINAL.pdf

41. Carrefour Brasil website. Available here: https://ri.grupocarrefourbrasil.com.br/en/our-businesses/retail/

environmental investigation agency

EIA UK
62-63 Upper Street, London, N1 0NY, UK
eia-international.org
+44 (0)20 7354 7960