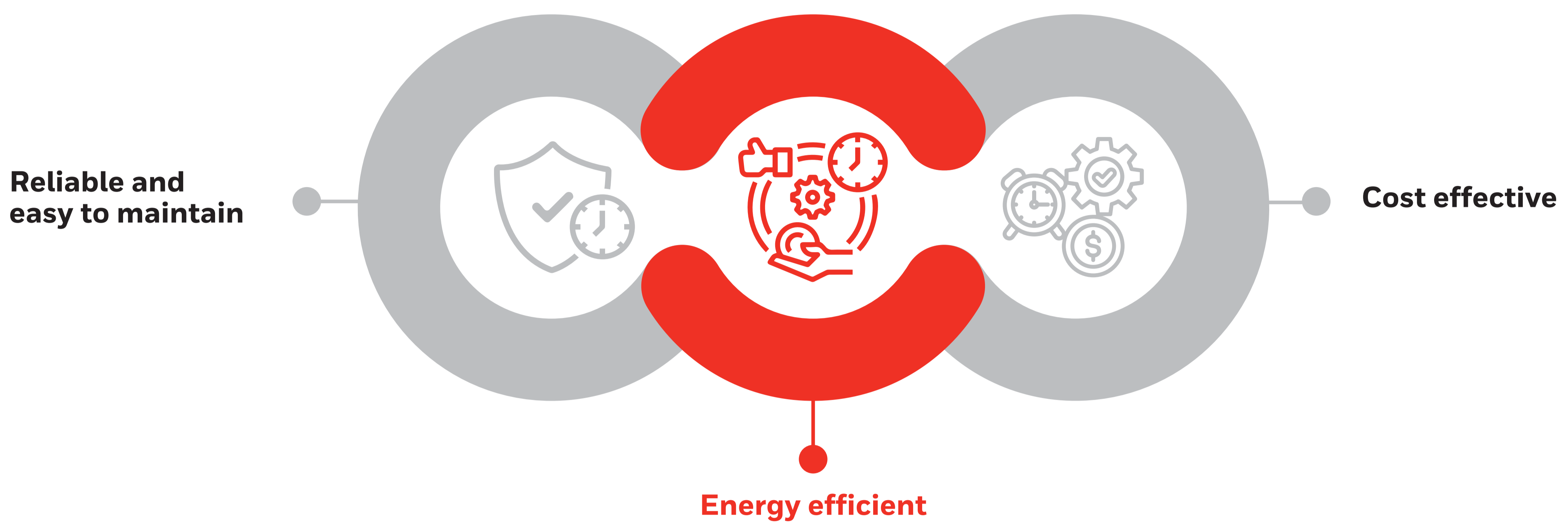


CHOOSING THE RIGHT REFRIGERANT AND IT'S NOT CO₂

Supermarkets face intense pressure to increase sales, reduce costs, and adhere to the regulations for phasing down the use of high Global Warming Potential (GWP) refrigerants. While grocers evaluate their refrigeration options, there is much more to consider than regulatory compliance alone.

While the right refrigeration system is critical to preserve perishable items and save grocery stores from losing money in food waste, it also represents a significant portion of a store's energy consumption and maintenance expenses.

The ideal refrigeration system should be:



That brings us to evaluate CO₂, a supposedly “natural” refrigerant that, despite having low GWP, falls short on several other factors that are important to supermarkets. These include:



Installation

Switching to CO₂ can be disruptive and costly. It requires entirely new equipment because CO₂-based systems function at high pressures, and as a result, need costly components that must withstand high-pressure conditions.



Excess Leaks

When a leak occurs in a CO₂ system, it is very rapid due to the high pressures of CO₂. Furthermore, there is no recovery equipment for CO₂, meaning repairs often lead to complete system discharge.



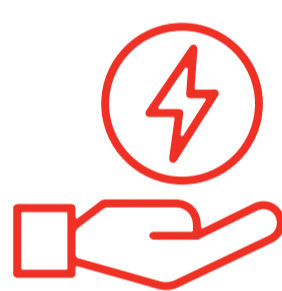
Maintenance

Unlike HFO-based systems, CO₂-based systems are complex and difficult to repair, and demand specialized skills and capabilities. This makes finding qualified technicians a real challenge. There are also concerns regarding whether a refrigeration system running at such a high pressure will have as long a lifespan as a traditional system.



Sporadic Supply

CO₂ has significant short-term supply and pricing challenges. As the fossil fuel-based economy winds down, it is anticipated that less CO₂ will be available as a byproduct of these industrial processes, thus creating the need to produce CO₂ refrigerant “on purpose.” This will impact the supply and significantly drive up the production cost of refrigerant-grade CO₂.



Energy Efficiency

More than 95% of a typical supermarket's lifetime greenhouse gas (GHG) emissions are generated through the system's energy consumption (scope 2 emissions), according to a lifecycle comparison of CO₂ refrigerants versus low GWP HFO-based refrigerants. Meanwhile, the emissions from refrigerant leaks (scope 1 emissions) have a significantly lower contribution of less than 5%.¹ Because commercial refrigeration CO₂ systems are less thermodynamically efficient, they consume 20% more energy than HFO-based systems, which dominate the overall lifecycle GHG impact.²



Reliability

Stores using higher-pressure CO₂-based systems must take precautions to ensure they can survive a power outage. During a power outage, refrigeration systems warm to ambient conditions. This requires a backup generator and an HFO/HFC refrigeration unit or an entire system's worth of CO₂ refrigerant onsite. In case of delay in managing the leak, the entire system may be down for extended periods, resulting in a loss of food safety and/or quality.

¹Based on Honeywell eco-efficiency simulation for 20 year period

²Technology Options for Low Environmental Impact Air-Conditioning and Refrigeration Systems, ORNL/TM- 2023/3041, Pub200582.pdf (ornl.gov)



IS CO₂ A "NATURAL" REFRIGERANT? YOU DECIDE.

Contrary to what the word *natural* implies, CO₂ is not captured out of the air, but is instead produced in large industrial plants, where it is captured as a fossil fuel byproduct and must undergo additional refining to achieve a refrigerant-grade standard.

It's time to reassess CO₂-based systems and consider a transition to low GWP refrigerants such as Solstice[®] HFO and HFO blends.

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