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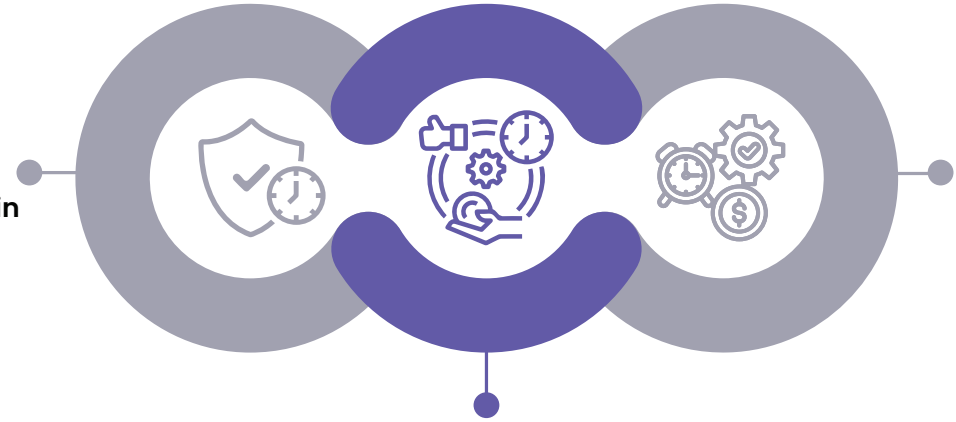
CHOOSING THE RIGHT REFRIGERANT AND IT'S NOT CO_2



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 CO_2, 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 CO_2 can be disruptive and costly. It requires entirely new equipment because CO_2-based systems function at high pressures, and as a result, need costly components that must withstand high-pressure conditions.



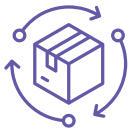
Excess Leaks

When a leak occurs in a CO_2 system, it is very rapid due to the high pressures of CO_2. Furthermore, there is no recovery equipment for CO_2, meaning repairs often lead to complete system discharge.



Maintenance

Unlike HFO-based systems, CO_2-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

CO_2 has significant short-term supply and pricing challenges. As the fossil fuel-based economy winds down, it is anticipated that less CO_2 will be available as a byproduct of these industrial processes, thus creating the need to produce CO_2 refrigerant "on purpose." This will impact the supply and significantly drive up the production cost of refrigerant-grade CO_2 .



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 CO_2 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 ercial refrigeration CO_2 systems are less thermodynamically efficient, they consume 20% more energy than HFO-based systems, which dominate the overall lifecycle GHG impact[2].



Resiliance

Stores using higher-pressure CO_2-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 CO_2 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.

1 Based on Solstice eco-efficiency simulation for 20 year period
2 Technology Options for Low Environmental Impact Air-Conditioning and Refrigeration Systems, ORNL/TM- 2023/3041, Pub200582.pdf (ornl.gov)

IS CO_2 A "NATURAL" INGREDIENT? YOU DECIDE.

Contrary to what the word natural implies, CO_2 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 CO_2-based systems and consider a transition to low GWP refrigerants such as Solstice® HFO and HFO blends.



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solstice.com

Solstice Advanced Materials Inc.
115 Tabor Rd.
Morris Plains, NJ 07950

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