

Financial Overview: Natural Refrigerants

Climate-Friendly Natural Refrigerants Have Not Yet Reached Economies of Scale

- As with any new technology, natural refrigerant adoption has not reached a ‘tipping point’ to increase economies of scale, so there is a cost premium associated with natural refrigerant technologies.
- As more supermarkets adopt natural refrigerant technologies, we expect to see a decrease in the costs of:
 - Components, equipment, and full systems as more equipment is produced;
 - Installation and maintenance as more service technicians become trained in naturals; and
 - Energy and operations as the performance of natural refrigerant technologies improves.

Upfront Costs are the Primary Barrier to Adoption of Climate-Friendly Natural Refrigerants

- The initial equipment and installation costs of new natural refrigerant systems [vary significantly across each installation](#), but the costs are cited as higher than current hydrofluorocarbon (HFC) refrigerant systems.
- Here is an example of a typical 30,000 square foot (mid-size) store (2019):

Installation Costs	Standard HFC-Based System	CO2 “Natural” System	Incremental Cost
Capital (System Equipment)	\$600k	\$770k	+\$170k
Labor	\$200k	\$280k	+\$80k
Total	\$800k	\$1.05M	+\$250k

***Note:** A supermarket refrigeration system refers to the network of pipes and other components that operate the refrigerated cases consumers see in the supermarket. The system is necessary for the cases to operate.*

- The cost of a supermarket refrigeration system varies so significantly across stores that there is no standard cost premium associated with natural refrigerant systems in new store construction. The example studies below support the **higher incremental costs** associated with natural refrigerants, but also demonstrate the **variation in cost** premiums for natural refrigerant systems:
 - One study found the initial cost of CO2-based systems to be [13% to 48% higher](#) than the initial costs of a traditional centralized HFC system (2015).
 - One food retailer compared the [initial cost of three natural refrigerant systems](#) to a baseline HFC system and found that the costs were 61% higher for a CO2 system, 101% higher for an ammonia system, and 136% for a hydrocarbon rack system (2019).
 - Another study comparing the initial cost of natural refrigerant systems to a baseline HFC system found the costs to be [16% to 65% higher](#) for natural refrigerant systems (2014).

The Cost Premiums are Much Higher in Existing Stores than in New Stores

- Unlike HFCs and other synthetic refrigerants, natural refrigerants are not a “drop-in” solution and require the [installation of entirely new refrigeration systems and equipment](#) for use, which represents a considerable capital cost in **existing stores**.
 - As an example, retrofitting a system with 3,000 lbs. (refrigerant charge found in average size store) of a commonly used HFO refrigerant would cost \$100k while the replacement of that existing system with a natural refrigerant system would cost over \$1 million, 10 times higher than the cost of a retrofit.
- It is extraordinarily rare for a supermarket to replace an entire system in an existing store, rather they would replace each system component (condenser, compressor, cases) as they reach the end of their life (the lifespan of refrigeration equipment is [estimated to be 10-20 years](#)). It is typical for a supermarket to replace major components in phases rather than replace the entire system at once.
 - As an example, replacing a condenser might cost \$100k while the replacement of the entire system with a natural refrigerant system would cost over \$1 million.

- Furthermore, replacing an entire system in an existing store may cause the store to temporarily close, representing a significant loss of revenue for that time period that makes this option unfeasible in most scenarios.

High Incremental Costs are Not the Only Financial Barrier to Natural Refrigerants

- Average supermarket profit margins are [roughly 1%](#), meaning that the average grocery store needs to sell \$100 in groceries to make \$1 in profit that can be put towards capital costs. Consequently, most supermarkets do not have the means to adopt refrigeration technologies that represent a cost premium.
- Due to the low adoption of natural refrigerant technologies, many service technicians have not been trained to handle natural refrigerants. As a result, the cost of maintenance can increase due to more time spent on site, training needs, and frequency of service.
 - Adequate training programs exist currently, but most service contractors cannot justify training their technicians on natural refrigerants if none of their customers are currently using natural refrigerants. The training barrier will likely be addressed as demand increases.