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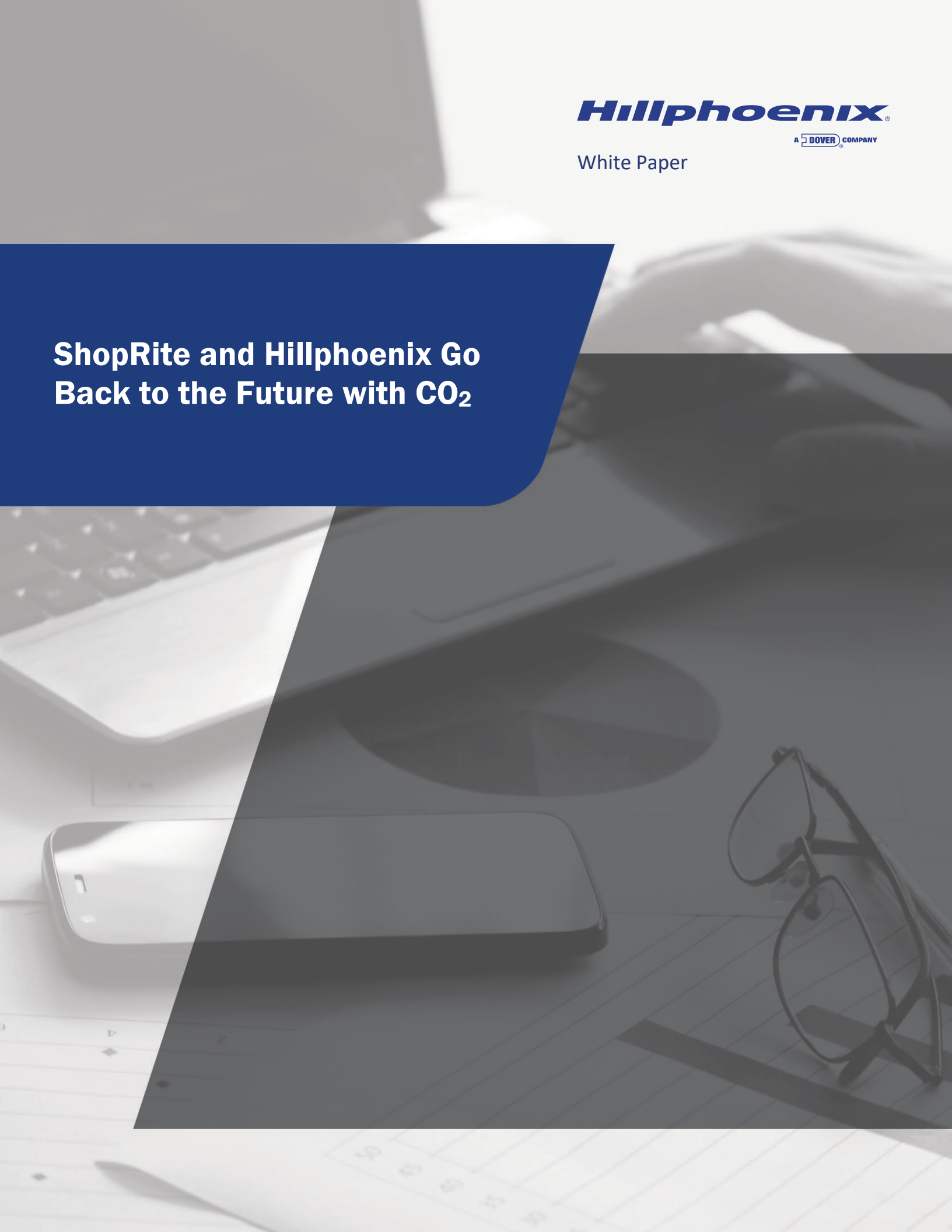
ShopRite and Hillphoenix Go Back to the Future with CO_2



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Background

The retail food landscape has never been more fraught with challenges and obstacles than it is now at this point in time. Post-COVID recovery, inflation, tariffs and supply chain disruptions are attempting to put a chokehold on profits as well as keep retailers up at night. But of all these threats, perhaps the real elephant in the room is the looming deadlines for compliance with federal and state refrigeration regulations. Usage of natural refrigerants, such as CO_2, propane, and ammonia, has surfaced as perhaps the most viable solution to the problem. Interestingly enough, the usage of CO_2 as a refrigerant serves as an example of the industry going "back to the future."

CO_2 is not new to refrigeration. It was one of the very first substances used as a refrigerant as evidenced by the submission of a British patent by Alexander Twining in 1850 and soon afterwards improved upon by Australian, James Harrison (*figure 1*). CO_2 as a refrigerant steadily increased in use, reaching a peak in the 1920s. By the early 20th century, numerous examples of CO_2 systems existed in a variety of sectors:

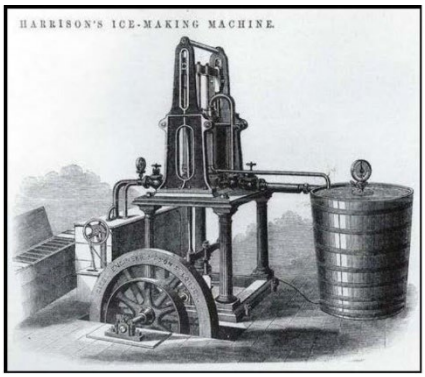

Figure 1: James Harrison Patent

- Cross-country and trans-Atlantic perishable food transportation
- Cooling in breweries and wineries
- Cooling in slaughterhouses and dairies
- Artificial ice production
- Cooling of ammunition magazines in warships

Subsequent to that, CO_2 usage declined with the introduction of chlorofluorocarbons (CFCs) that operated at lower pressures, albeit at the expense of adverse environmental issues.

Heavy promotion of CFCs by the chemical industry contributed to the disappearance of CO_2 from the market by the 1940s.

Cingari Family Markets ShopRite History

Cingari Family Markets ShopRite, located in Stamford, Connecticut, serves as the prototypical model for meeting these regulatory challenges head on and emerging successfully by converting their existing store refrigeration systems to CO_2. This comes as no surprise to those who are familiar with the Cingari family history in the retail food business ... a history that is steeped in entrepreneurial spirit, hard work, and traditional family values. In 1929, Salvatore Cingari used his life savings to purchase a school bus (*figure 2*), filling it with fresh produce and pasta, and travelling the outskirts of Stamford to ensure that everyone had access to quality food. From the opening of the first Grade A Market in 1943 by Salvatore in Stamford, to the transformation in 1960 by his three sons of an old 4,400 square-foot ice cream factory into the first Grade A Supermarket, to their joining the ShopRite family in 1991, this commitment to excellence, along with a sincere love for food, has carried on to the 12 stores in their present day portfolio.

Figure 2: Salvatore's school bus

The Cingari Family Market ShopRite stores are under the umbrella of Wakefern Food Corporation, the largest retailer-owned cooperative in the United States. Wakefern is comprised of member companies that independently own and operate 365 retail supermarkets under a variety of names in nine Northeastern states. Through pooling their resources, these member companies have profited in many ways, none the least being the beneficiaries of the powerful purchasing leverage wielded by the co-op.

Regulatory Storm Clouds on the Food Retailers' Near Horizon

Food retailers like ShopRite have been subject to ever increasing regulatory pressure to reduce ozone depleting substances since the enactment of the Montreal Protocol in 1989. On the federal side, the U.S. EPA AIM (American Innovation and Manufacturing) Act, signed into law December 27, 2020, authorizes the EPA to address hydrofluorocarbons (HFCs), a

category of potent greenhouse gasses, by providing new authorities in three main areas: to phase down the production and consumption of listed HFCs, manage these HFCs and their substitutes, and facilitate the transition to next-generation technologies through sector-based restrictions.

A phasedown of the hydrofluorocarbon supply in the United States is already underway. The first step in 2022 saw the supply of HFCs being cut by 10%. Next, a 30% drop in the supply was implemented in 2024, bringing the total supply phase-down to 40% compared to pre-AIM Act baseline levels. Another 30% drop is scheduled for 2029, then another 10% drop occurs in 2034, followed by the final scheduled drop of an additional 5% by 2036. In total, an 85% reduction in the baseline supply of HFCs is scheduled to occur by 2036. As supply drops, it is projected that the cost of the refrigerant will go up and continue to rise over time as supply is further restricted.

Additionally, supermarkets installing new refrigeration systems after January 1, 2027, face significantly tightened refrigerant restrictions, namely:

- 300 GWP (Global Warming Potential) limit for systems with less than 200 pounds charge.
- 150 GWP limit for systems with greater than 200 pounds charge.

In addition to federal-level U.S. EPA requirements, individual states have added to the complexity with the formation of the Climate Alliance, a bipartisan coalition of governors from 24 states that represent approximately 55 percent of the country's population and 60 percent of the economy. Their stated goal is a net-zero future for America. This directly impacts Cingari Family Markets ShopRite since Connecticut, where their stores are located, is a member state of the Climate Alliance. Part of the challenge is that in a number of cases, the state level regulations may supersede those imposed by the EPA.

Connecticut has adopted regulations that align with the EPA's SNAP Rules, particularly Rules 20 and 21 which were initially vacated by the courts, that identify and restrict certain HFC refrigerants in various refrigeration and air conditioning applications.

As a member of the U.S. Climate Alliance, Connecticut is committed to reducing net greenhouse gas emissions by at least 26-28% by 2025, 50-52% by 2030, and 61-66% by 2035, all below 2005 levels. The state is also committed to achieving net-zero emissions by 2050.

The Decision to Go with CO_2


The Cingari's at the opening of their Shippan Ave. Store. Mrs. Salvatore Cingari, Mr. Salvatore Cingari Sr., Sam Cingari, Rocky Cingari, Dom Cingari and Chipper Cingari.

Figure 3: Past Cingari Generations

While the primary motivation to comply with regulatory mandates for most food retailers today is near-term self-preservation, the driving force behind the Cingari Family Markets ShopRite decision to act was born of a deeper, altruistic desire to provide a viable long-term business, positioned for success, for future family generations (*figure 3*). To lay the framework for this to happen, Cingari Family Markets ShopRite co-owners, Joe and Tom Cingari (Joe's cousin), took the initiative to formulate a 20-year "prescription for success" vision for the business. Integral to this plan was the decision to "future-proof" the business by addressing the refrigeration compliance mandates up front. In the words of Joe Cingari, "We needed to ensure that our legacy of quality and service to our customers would thrive for years to come."

Their decision of how best to achieve the desired goal converged rather quickly on using natural refrigerants, but the question then became, "which one?" Consideration was given to various alternatives. For instance, the efficiency and energy ramifications of using propane looked promising initially. However, upon further investigation, they were concerned by the number of compressors required and the potential noise on the sales floor.

Although the decision was made to use CO_2, it was not devoid of initial concerns. Wakefern had reservations about the maturity of CO_2 technology that manifested in concerns about the complexity of the technology, first cost, and availability of CO_2 service expertise in the area. Joe Cingari's uneasiness was somewhat more limited and focused on initial cost.

Meeting the Challenges of a Store Remodel with CO_2

Fast forward to today. Cingari Family Markets operates 12 ShopRite stores, with 6 of them either already converted to CO_2 or in the process of doing so. The experience they have gained has mitigated any initial concerns they had ... but more about that later.

CO_2 refrigeration system installations take on one of two formats: either a new store installation or an existing store remodel. Of the two, the store remodel presents the greater challenges, none the least being the ability to fit everything in the existing footprint as well as perform the conversion from the old to the new system without adversely impacting store operations and profitability. This case study will focus on the remodel scenario and use the most recently converted ShopRite store in the Cingari Family Markets portfolio located on Commerce Road in Stamford, Connecticut (*Figure 4*). The store is 80,000 sq-ft in size with a refrigeration load requirement of 850,000 BTU.

Figure 4: Commerce Road ShopRite

Each remodel poses its own set of issues. The refrigeration rack might be destined for a machine room located on the same floor as the store operations, or other placement alternatives, such as mezzanine, rooftop, or outdoors. Finding the way to get the rack to its intended location within an existing store can be a daunting task, often requiring a creative approach. The Commerce Road ShopRite store called for mezzanine mounting, however, the freight elevator was incapable of handling the size and weight of a rack, and the store logistics did not offer the option of using a crane to lift the rack to its final point of placement from inside the store. So, Joe Cingari and his team got creative and cut a hole in the store roof just large enough (6 inches of clearance on each side) to lower the new CO_2


Figure 5: Lowering rack through roof

rack in place with a crane from outside the store before recovering the rooftop (*figure 5*).

The Commerce Road ShopRite CO_2 System

Figure 6: Hillphoenix Advansor CO_2 system

The CO_2 system installed in the Commerce Road ShopRite store remodel project consisted of a pair of Hillphoenix Advansor CO_2 refrigeration racks (one positioned on each end of the mezzanine) employing Danfoss AK-SM 850A controllers together with an energy management system (*Figure 6*). The purpose of having two racks was twofold in nature. The determination was made that piping runs would be excessively long if only using a single destination. Additionally, having the second system made the logistics of transitioning from the old HFC system to the new CO2 system easier as they ramped up the BTU load on CO2 and down on the old rack in a phased manner.

Pre-piping for the new Commerce Road store CO_2 system (and each subsequent remodeled store) started ten weeks in advance with the intent of having the vast majority of the required piping already in place by the time the new racks arrived in January 2024 (four weeks before commencing the phased case changeout). Continuing with their innovative thinking, Joe's team paid for having existing system evaporators relocated to select medium-temp and low-temp walk-in boxes such that the new CO_2 systems' evaporators could be placed in the same location. This allowed for the availability of both systems to ensure flexibility when adding and shedding refrigeration load during the transition. The conversion process, involving each section of the store being incrementally brought online with its new CO_2 cases, was performed in a phased fashion throughout 36 nights (from mid-January 2024 to the week before Memorial Day) with the load balanced after each move.

Essential Process Ingredients for Achieving a Successful CO_2 Remodel

Figure 7: Brian Cleary

One profound key to success was ensuring that the refrigeration contractor and general contractor set and maintained the remodel schedule. In order to avoid the "tail wagging the dog", the merchandising team conformed to that schedule instead of the merchandising team setting the schedule. Furthermore, all equipment for the project was delivered, available, and stored locally so that the schedule was not subject to any interruption due to freight issues or equipment delays.

Figure 8: Joe Sigg

According to Brian Cleary (*Figure 7*), vice president of sales at AMF Sales & Associates (a Hillphoenix manufacturing rep and dealer), "Successfully remodeling a store with CO_2 refrigeration requires three things ... phasing, planning, and the right team." Properly phasing the integration of the new CO_2 system in a piecewise fashion allows for uninterrupted store operations and transparency to both customers and employees alike. Joe Sigg, senior project engineer at Wakefern (*figure 8*), who acts as a technical consultant to help facilitate new installations and remodels for member stores of the Wakefern co-op, echoed Brian's emphasis on planning by stating, "Meticulous planning is paramount to success. Plan, plan some more, and when you think you've planned enough ... plan some more!" Having the right team who works together cohesively and communicates effectively with each other can make or break your project. Joe Cingari (*figure 9*) put it in perspective by stating, "In the case of our Commerce Road store remodel, we had all the right players working toward the same goal—and that made all the difference in the world! The level of CO_2 knowledge and experience that Hillphoenix brought to the party, along with the service and responsiveness of the dealer (Brian Cleary) and the refrigeration contractor, turned an otherwise daunting task into a straightforward, manageable situation."

Figure 9: Joe Cingari

The Outcome and Learning Points for the Future

The remodel effort of converting the Commerce Road ShopRite store to CO_2 was completed in essentially four months from the time the new rack arrived on-site to the final changeout of the 106 cases on the floor. “Looking back on the entirety of the installation and commissioning, there really were no problems of note”, said Brian Cleary. Joe Cingari offered a powerful testament to the team’s success by adding, “The manner in which we transitioned from the old HFC system to the new CO_2 system turned out to be essentially transparent to our employees and customers. We incurred no operational downtime or adverse effects on sales and profit.” Any lingering concerns that Joe Cingari may have had initially disappeared completely by the project’s conclusion.

The success of the Commerce Road store led to the immediate remodel of two additional stores, which have since been completed. Driven by these successes, there are currently three more CO_2 remodel projects in progress.

One lesson learned that will aid future remodel installations is the need to change oil filters more frequently during the transition period from the old to the new system. The effect of incrementally swapping out the cases on the sales floor over a period of 36 nights caused a greater-than-expected level of contaminants in the system. Changing the filters more often during this period mitigated the issue.

Tangible benefits of the new CO_2 system have already begun to surface for Cingari Family Markets ShopRite. Wakefern's Joe Sigg highlighted some of the more notable benefits. "Electrical consumption has decreased by 15% as part of this store remodel, with the CO_2 conversion playing partly into this. But perhaps the most important of all benefits is the fact that with the conversion to a natural refrigerant, Cingari Family Markets ShopRite is now immune to the regulatory threats facing others still using HFC systems. Joe Cingari summed it up with, “Peace of mind is a beautiful thing in this business! We have positioned the next generation of our family for success.”

Besides the tangible operational benefits realized, remodeling with a natural refrigerant broadcasts to customers and non-customers alike that Cingari Family Markets holds environmental responsibility near and dear to their hearts. With their conversion to a natural refrigerant, the Commerce Road store has positioned itself to earn GreenChill certification (*figure 10*), a program initiated by the EPA in 2007, that encourages the use of more environmentally friendly refrigeration technologies and refrigerants and offers a Store Certification Program to recognize stores that excel in reducing their environmental impact.

Figure 10: GreenChill Certification

Conclusion

With the aid of meticulous planning and near-flawless execution by Joe Cingari's team, the remodel of the Commerce Road ShopRite store was accomplished with minimal issues. Cingari Family Markets is now a believer in the power of CO_2. They have 6 stores, either already converted or in the process of doing so. Their Brookfield store is next in line and will employ an external machine room to house the rack. "Although the creative 'hole in the roof' approach for placing the rack in its final position worked in the case of the Commerce Road store, we're going to try to avoid that if we can in the future", Joe Sigg stated somewhat light-heartedly.

From the point of its initial usage in the 1800s to what has now transpired, CO_2 as a refrigerant is a great example of "what goes around comes around." Indeed, with its remodeling of stores to CO_2, Cingari Family Markets has gone "back to the future."