When you stop and think about it, it’s a little strange that supermarkets usually pay to heat their premises and water while their refrigeration system works overtime to move heat energy outside.

Once, this might have seemed sensible: having discrete, isolated systems can give retailers’ technical teams a sense of control. There’s also less risk that a major fault might incapacitate the whole system.

Conventional HFC refrigerants also lacked the discharge temperature necessary to drive a heating system without several additional components. This added to installation costs and complexity and made payback relatively slow.

Supermarket refrigeration, heating, air conditioning, and ventilation work best as an integrated solution. Here’s why.
Unlocking the potential of supermarket heat recovery

At Danfoss, we wanted to prevent these kinds of problems, simplify the process, and bring supermarket heat recovery into the mainstream.

We’ve therefore combined our heating and refrigeration expertise to create a purpose-built Heat Recovery Unit (HRU), perfect for supermarkets. It’s now proving its worth in supermarkets across Northern Europe, where CO₂ is well established, and we look forward to seeing it deliver results worldwide.

The HRU solves many of the traditional issues with heat recovery—notably by giving engineers a well-defined design, common components, and clear service requirements. It includes an extra heat exchanger set to prevent breakdowns and leakage and temperature buffer tanks to prevent stress in moments of peak demand.

The result is an easy, self-contained way for supermarkets to harness the heat recovery potential of CO₂ refrigeration systems, using a system built by one of Europe’s leading manufacturers of heating systems. It also opens the possibility of selling excess heat to neighbors in a controlled way, using approved heat meters—which can increase the benefit of using the store’s compressors as a heat pump. It adds up to a rapid cost savings. If you have a CO₂ system, payback is typically within 1-2 years—sometimes sooner.

While the theory is simple, supermarkets have historically faced a number of challenges with implementing heat recovery successfully.

Usually, systems were created, modified, or retrofitted on a bespoke basis. This limited servicing options. And in some systems, large temperature fluctuations in the heat exchanger led to CO₂ leakage into the water—creating caustic acid that damaged water lines.

In that context, and with the growing popularity of CO₂ as a refrigerant, integrating HVAC and refrigeration systems has become a serious option supermarkets can no longer ignore.

Now, it’s time to look again. Energy costs are rising, and margins are low. Retailers are fighting to reduce their carbon footprint—and to find energy savings wherever possible.

Integrating other kinds of AC systems

It’s also possible to integrate several approaches within a non-CO₂ air conditioning (AC) system to improve efficiency and reduce GWP.

For example, in large, hypermarket-scale applications—or where there’s a large AC load—an oil-free centrifugal Danfoss Turbocor® compressor can run chillers in combination with air-handling units (AHUs).

This integrated solution makes both services extremely energy efficient and opens the possibility of using ultra-low GWP, HFO refrigerants like R1234ze. In China, a Suguo hypermarket cut its AC energy costs by 50% by using exactly this solution.

Reacting to changing load conditions is also important. So, for standard rooftop chiller scenarios, using a variable-speed compressor gives an immediate way to improve year-round energy efficiency across every part of the system. This can be further integrated with an extra coil and rooftop ice bank to even out peaks in load and make the best use of cheap energy when it’s available.

Integrated solutions need smart controls

However, there is no such thing as a standard configuration. Each individual store faces different challenges.

An integrated solution may need to include measures to manage humidity, account for ambient temperature changes, or combat frosting and fogging. The system might incorporate a plug-in hydronic system with balancing valves, or fan speed control.

That means the central part of any integrated system must be a smart controller—with the right algorithms to make the best use of all the technology in your solution.

For example, the Danfoss MCR controller lets you take a modular approach, building in expansion and accessory modules to suit your system’s exact needs. It also lets you program your system graphically through its own design app.

Connecting your controller to an in-store system manager like the Danfoss AK-SM800 makes it smarter still. Now, you can link in other building management systems and tune performance across the whole store through a single interface—so you can trade off different aspects to achieve the best energy profile overall.

An integrated system is a better system

Ultimately, the closer you align your heating, ventilation, air conditioning, and refrigeration systems, the easier it will be to save money, safeguard stock, and reduce your environmental impact.

As an added benefit, an integrated solution reduces the chance of separate system suppliers disputing the cause of issues, delaying fixes, and jeopardizing food safety.