System Type: Transcritical CO2
Refrigerant: R-744 (carbon dioxide)
GWP: 1

Store Size: 19,536 gsf (gross square feet)
ASHRAE Climate Zone: 6
Utility Provider: Central Maine Power
Average Electricity Cost: $0.11/kWh
System & Charge: Transcritical CO2 / 600-lbs R-744

Key factors affecting decision:
This was a new, smaller-format store within a one-hour drive of Hannaford’s corporate office.

Note:
Propane is used for space and water heating.

System: Transcritical CO2 (TC), with 600-lb charge of R-744 (carbon dioxide).

System location: Rack is in a mechanical “pod” located behind the store (pre-fabricated structure from the equipment supplier, with the rack inside). Gas cooler is on the roof.

System capacity: Low temp capacity is 115,500 Btu/hr to serve a load of 111,800 Btu/hr at -21°F. Medium temp capacity is 521,600 Btu/hr to serve a load of 370,200 Btu/hr at +15°F plus the LT rack condensing load. Total heat of rejection is 886,600 Btu/hr.

System uses electric defrost and utilizes heat reclaim with a glycol distribution system. Other factors affecting the system choice:

• TC supports GHG and GWP reduction goals.
• TC CO2 is Hannaford’s standard approach for new stores.
• Anticipate good performance in terms of energy and maintenance.
• Being a small store, the scale of the system was a more manageable.

Baseline & Comparison: This store is Hannaford’s first 20,000 gsf prototype. While it would be possible to compare with some older stores of similar size, there could be significant differences in site loads, lighting, equipment, doors on display cases, etc. The store came on line in August of 2015.
QUANTIFYING CHANGES IN ENERGY USE

Hannaford expects energy performance to be similar to their previous prototype system (DX refrigeration with R407A and full-condensing heat reclaim using glycol distribution). Hannaford expects the savings to persist, because they monitor monthly electricity use and will take corrective action if energy use increases substantially.

The system has electronic controls, and initial settings were confirmed. Sub-metering data is not yet available.

The glycol heat reclaim system provides heating to the main HVAC unit:
- For first stage of heating in cold weather
- For reheat in humid weather

INSTALLING & MAINTAINING THE SYSTEM

Safety measures:
- Pressure relief valves where needed (dual valves in parallel with isolation valves, in case one valve doesn’t reseat properly)
- Provision to connect a mobile backup generator to power the entire store, in case of long-term power outage (Added $50k+/- to the cost.)

Hannaford did not provide information about capital costs, the commissioning process or whether there is an EMS or automatic control system.

WHAT HANNAFORD SAYS

“The overall commissioning and installation process was complicated by poor design and equipment selection of the gas cooler, resulting in an under-sized gas cooler.

This problem was compounded by an even poorer design of the larger gas cooler that was furnished to replace the original unit; it did not work and caused a two-day refrigeration outage at the store, which was a major problem.

This highlights the newness and relative lack of availability of this equipment; there was no suitable equipment available within 500 miles that we could obtain to get the store back on line. Now that the above problem has been properly addressed (we have a properly sized, properly designed gas cooler installed), the system performance is in line with expectations.”