WHOLE FOODS MARKET
DUBLIN, CA
CASE STUDY #4, AUGUST 2016

<table>
<thead>
<tr>
<th>System Type:</th>
<th>Refrigerant:</th>
<th>GWP:</th>
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<tbody>
<tr>
<td>CO2 / NH3 Cascade</td>
<td>R-744 / R-717</td>
<td>1/0</td>
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Store Size: 40,689 gsf (gross square feet)
ASHRAE Climate Zone: 3
Utility Provider: Pacific Gas & Electric
Average Electricity Cost: $0.16/kWh
System & Charge: CO2 / NH3 Cascade

SYSTEM BASICS

System: CO2 / NH3 Cascade with 1,440-lb charge of R-744 (carbon dioxide) and 250-lb charge of R-717 (ammonia).

System location: The CO2 rack is located on the mechanical platform and the NH3 rack is located in house on the roof.

System capacity: Low temp capacity is 126M BTU/hr and medium temp capacity is 618M BTU/hr.

This store is located about an hour outside of San Francisco headed toward the central valley. At the time, there was very little information about transcritical CO2 in warm climates, but Whole Foods was committed to a natural refrigerant solution.

Key Characteristics:
Low-temp DX CO2 with medium-temp liquid overfeed CO2, cascaded to R-717 hybrid condensers; using electric defrost. This system is a suburban location with a warm ambient climate, and was the first of its kind in the U.S. when it was brought on-line.

The Dublin area is surrounded by many industrial ammonia cold storage facilities, thus Whole Foods felt this technology was an opportunity to pilot a natural refrigerant solution and compare it to its deployed HFC DX systems, HFC/CO2 cascade systems and transcritical CO2 systems.

This system was a first of its kind for Whole Foods and at the time it was brought online it was the only system of its kind operating in a U.S. grocery store. Whole Foods has encountered several issues with the NH3 rack and has been continually commissioning and changing out equipment during the first year of operation.

Safety precautions include a shower in case of a NH3 leak, as well as personal protection equipment to deal with a small discharge of NH3.
QUANTIFYING & COMPARING ENERGY USE

Whole Foods Market does not have a typical system in the same climate zone built around the same time. Generally, a typical system for Whole Foods would be a R-407A DX parallel rack configuration. In this case, Whole Foods used a distributed R-407A scroll unit system with hybrid condensers at a 39,026 gsf (gross square feet) store in Fremont, CA as a baseline.

Case doors are a standard practice for CA stores, and the department formats are similar in terms of case lineups. The installation costs for this CO2/NH3 system were roughly double the comparable baseline system.

This CO2/NH3 system has electronic controls and initial settings were confirmed during commissioning. Operating guidelines changed slightly during the first year, due to lessons learned in the field.

The CO2 and NH3 racks have separate sub-meters, as do the two hybrid condensers. Twenty-five percent of the heat rejected off the rack is utilized for space heating, the remainder is used for pre-heating domestic hot water.

WHAT WHOLE FOODS MARKET SAYS

“Due to continual commissioning and the need for equipment swap outs like valve and compressor replacements, service costs have been higher than expected.

Ultimately, we expect energy savings and decreased servicing needs as compared to a traditional system. Simply put, we need more than one natural refrigerant solution and this system is a viable option.

We remain confident that it will meet our expectations, and the installing contractor and OEM have stood by their commitment to deliver on our expectations.”

<table>
<thead>
<tr>
<th>Average Energy Consumption (Annualized kWh/Sq Ft) by System Type</th>
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<tbody>
<tr>
<td>Whole Building</td>
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<tr>
<td>Refrigeration</td>
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<tr>
<td>HVAC</td>
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<tr>
<td>Lighting</td>
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<tr>
<td>Other</td>
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