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## GREEN INNOVATIONS IN COLD STORAGE CONSTRUCTION

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# GREEN INNOVATIONS IN COLD CHAIN CONSTRUCTION

*Eco-friendly design and mechanical elements can be good for everyone as well as the bottom line.*

**B**uilding a cold chain facility and/or distribution center that is eco-friendly is not only good for the environment; it can save on energy costs. And those savings go straight to a company's bottom line. Cost is the major consideration today, industry experts observe.

Glenn Keeler, Cold Box Design Build Manager – Cold Storage & Logistics for Cold Box Builders in Concord, Ontario, reports how many companies today are replacing systems to be energy efficient and save money.

One example is LED lighting in freezers. “They don’t generate any real heat, so that’s a reduction on the load of the refrigeration system,” Keeler says.

Some customers are also replacing old metal alloy lights with LEDs. “Companies that utilize T5 and/or T8 fluorescent lights find that while these give off better lighting, they do not offer the same return on investment as LED lighting,” Keeler says.

Other eco-friendly materials include white roofs that reflect heat rather than black roofs that absorb it. “But that’s a difficult discussion in Canada, where the climate seems like winter most of the year,” he comments.

Another energy efficient system is vertical dock door levelers used with a dock configuration to allow trailer doors to swing open into the building after the trailer is docked.

“This is an area where there is big energy loss,” Keeler says. “With the new vertical levelers, companies can save money through lower energy bills since they keep the cold air from getting out. They also reduce the chance of pests getting into the building.”

Reclaimed heat from the hot gas of an ammonia system can be used for office heating or heating the loading dock when required. Hot gas from the refrigeration system put through a heat exchanger can be used for other requirements, such as hot water for wash rooms.

Dan Crist, Vice President of Charlotte, North Carolina based design-build firm A M King, states the majority of their clients are focused on the refrigeration system. “They want to ensure the system is designed and installed to achieve maximum efficiency,” he says.

He points to Variable Frequency Drives (VFDs), which are used to control compressor and fan motors on refrigeration equipment. Recently, A M King installed VFDs on all new and existing fan motors on

a 60,000-square-foot cold storage expansion project in Michigan.

“If we expand an existing, older facility, we are retrofitting the refrigeration system with VFDs,” he says. “VFDs help extend the life of equipment because the motors are not running at 100 percent during all times. The efficiency created with VFDs leads to significant energy savings for the client, and paybacks are calculated for each specific project. When clients want the most efficient system, one of the first items we discuss are VFDs.”

Crist also sees the benefits of LED lighting. “LED lights are more efficient, and control systems are capable of maximizing efficiency through scheduling and adjustment of output,” Crist says. “Several hundred light fixtures will likely be required in a large cold storage facility, and by utilizing the most efficient fixtures, the client will see significant energy savings.”

However, LED fixtures require a greater upfront investment for the client. Crist estimates they can cost up to four times the amount of T5 fixtures, depending on the selected manufacturer and options. “The initial sticker shock is there for clients unfamiliar with the cost of LED fixtures. However, when you calculate the energy savings and payback, most of our clients are making the initial investment.”

## Mechanical Focus

Matthew Simmons, Marketing Director of ISD Solutions in the United Kingdom, reveals that



Primus upgraded the baseline lighting to LED lighting with motion sensors at the U.S. Cold Storage (USCS) facility in Covington, Tennessee. This increases light efficiency and reduces power. (Photo courtesy of Primus Builders.)



The U.S. Cold Storage facility in Covington, Tennessee, featured landscaping with native plantings. These plants are drought-resistant and require no potable water and very little fertilizing or pest control. Some 20 percent of construction materials including concrete and structural steel, were sourced within a 500-mile radius. (Photo courtesy of Primus Builders.)



Aldi's new cold store and warehouse was built using ISD's single envelope construction to increase energy efficiency. (Photo courtesy of ISD Solutions)

system from Kingspan. Twenty thousand square meters of controlled environment insulated wall panels were installed on the project to ensure controlled temperature levels within the cold facility. Top deck insulated panels were also used for its ambient roof. A press release on the project points out that the 1.5MWp solar PV system of 10,000 square meters covering around 15,000 square meters of roof area consists of 6,000 modules, 250 Wp each. This provides Aldi with 1.2 GWh of electricity per annum, improves the energy performance of the building, and reduces its lifetime running costs.

### LEED Certified

Many design/build elements, such as solar panels, have gained popularity because of heightened interest in LEED certification. While interest in solar panels has waned somewhat due to fewer available incentives, companies like Primus Builders, a provider of design-build services, has been involved in a host of LEED certified buildings. In fact, the company has three projects considering LEED certification.

"Many of our clients have made the corporate decision to set an industry standard for sustainable design and construction," says Matt Hirsch, President, Primus Builders. "Key areas of focus include decreasing energy consumption, achieving zero landfill, and pursuing larger quantities of locally sourced materials."

One example is a recent project for Mullica Hill, a member of AGRO Merchants Group, where Primus provided design and

in recent years his firm has seen an increase in clients looking to build large temperature controlled facilities or distribution centers using a "single envelope" design.

"This is where the coldstore is also the external of the building," he explains. "This contrasts to the traditional and still widely used method of construction, which is effectively having two buildings, one inside the other."

The latter configuration requires insulation between the shells and a roof void for a fire prevention sprinkler system. "These are costly, in terms of raw materials, time consuming to build, and not particularly sustainable or energy efficient," Simmons says. "With a single envelope construction, build times are faster and fewer materials are required and that results in cost savings."

Designing a single envelope building

includes selecting appropriate materials such as thicker insulation, which lower the "U value" (the rate of heat transfer through a building element over a given area under standardized conditions), and save on energy costs. The final stage, installation, ensures the required air tightness that maintains the thermal efficiency of the cold facility.

"IACSC recommendation for air leakage is 0.5m<sup>3</sup> per hour per m<sup>2</sup> at 50 Pascal's," Simmons adds. "We aim to achieve 0.2m<sup>3</sup> per hour per m<sup>2</sup> or less and have installed several single envelope projects that have achieved 0.1m<sup>3</sup> per hour per m<sup>2</sup> at 60 Pascals."

An example of such a project is Aldi's new cold warehouse and distribution center at Goldthrope, near Barnsley, England. Here, ISD Solutions incorporated high performance insulated panels and a solar PV

construction services on a 130,000-square-foot cold storage facility in Pedricktown, New Jersey.

“New Jersey provides incentives to firms that incorporate renewable energy components into their businesses,” Hirsch explains. “It was imperative to Mullica Hill that the team focus on reducing energy consumption and earning those incentives.”

Primus proposed several options: The ALTA Expert System (a refrigeration system that does not require an engine room but operates as standalone roof top units with evaporators inside the refrigerated space that provide cool temperatures while taking up less space, using less piping and using less energy); LED lighting outfitted with motion sensors to reduce energy, and VFDs on larger motors, which allows for motor speed control.

“Mullica Hill incorporated all of these suggestions,” Hirsch reports. “Because the savings were more than five percent above the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) established level for lighting, the New Jersey Clean Energy Program awarded Mullica Hill their incentives.”

Another project in which Primus Builders was involved was the U.S. Cold Storage (USCS) facility in Covington, Tennessee. The challenge here was the fact the design-build required the new 315,000-square-foot distribution and warehouse facility to be attached to an existing 815,000-square-foot ice cream production facility operated by Unilever.

“The LEED scorecard was studied, and only points that would maximize USCS and Unilever’s return on investment were



LEED points are being achieved in areas like sustainable sites, water efficiencies, materials and resources, energy and atmosphere, and innovation and design.”

— MATT HIRSCH, *President, Primus Builders*

selected,” Hirsch explains. “LEED points are being achieved in areas like sustainable sites, water efficiencies, materials and resources, energy and atmosphere, and innovation and design.”

Specifically, evaporators were installed with a lower fan horsepower to capacity ratio and control evaporator speed with VFDs to save energy by reducing the motor power and the refrigeration load contribution from the evaporator fan motors. A VFD was installed on the reciprocating booster compressor to save energy by improving part load compressor efficiency. The compressor oil cooling was upgraded from liquid injection to glycol, which increases compressor capacity and reduces compressor shaft power requirements.

“It also requires a condensing pressure of only 90 psig compared to liquid oil cooling, which requires 120 psig,” Hirsch explains. “Primus will also install a VFD on the high stage screw compressor to improve the efficiency of the part load compressor.”

In addition, Primus installed oversized condensers with a higher MBH/horsepower ratio to increase energy efficiency by reducing motor power. VFDs were installed to control condenser fan speed. Lighting was upgraded

to LED lighting with motion sensors, and motion-activated, low-flow fixtures were installed to reduce water waste.

“As a result, this building uses 44 percent less water than a typical building of its size,” he says.

Other elements included using native plantings in the landscaping that are drought-resistant, and sourcing regional materials.

“This regional sourcing approach reduced carbon emissions associated with transporting the materials,” he adds.

Primus installed solar-reflective materials to ensure the building’s roof and paved areas do not create an irregular “heat island” in a rural setting. Light pollution was mitigated with outdoor fixtures that cast light downward and not beyond 15 feet of the property.

In addition, Primus honored USCS’ goal of recycling 75 percent of all related construction waste and demolition debris. “This minimized negative impact on the landfills and diverted reusable materials back to the manufacturing process,” Hirsch explains.

Hirsch emphasizes that with the advent of the International Green Construction Code, owners have a standard for minimum sustainable requirements that is universal around the world. “One area that is receiving more attention today is the focus on *how* a sustainable project is built,” he remarks.

When asked what best practices and standards he sees being introduced today for companies to follow, Hirsch points to the most prevalent as: low charge ammonia refrigeration systems; facilities designed to support future sustainable elements such as reinforced roofs to support future use of solar panels; and water reduction in refrigeration.

“Public refrigerated warehouses require 50 to 100 gallons per minute to operate,” he stresses. “Reductions in refrigeration process water offer a large opportunity for improvement.”



Primus installed solar-reflective materials to the U.S. Cold Storage facility in Covington, Tennessee, to ensure the building’s roof and paved areas do not create an irregular “heat island” in a rural setting. Light pollution was mitigated with outdoor fixtures that cast light downward and not beyond 15 feet of the property. (Photo courtesy of Primus Builders.)

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