



PROJECT REPORT

PRJ45/2000

Ice Thermal Storage – A Great Idea with Many Applications

The success of ice thermal storage in office building applications has received a great deal of publicity and exposure. However, ice thermal storage has been successfully implemented in all types of buildings for many of the same reasons it works in office buildings: lower first cost, lower operating cost and the ability to eliminate CFCs. This report addresses many of these "other" applications.

The use of low temperature water from the ice storage allows savings in piping, pumps, and air handling equipment. An ice storage system with supply and return water temperatures of 34°F (1°C) and 54°F (13°C) versus a traditional system using 44°F (7°C) to 54°F (13°C) requires half of the water flow, 1/8 the pump BHP and smaller pipes. In addition, low supply temperatures allow for smaller airside coils. When low temperature air distribution (42°F (6°C) supply air versus

traditional 55°F (17°C) air supply) is also used, additional savings are realized from smaller ductwork, smaller fans and increased useable space.

Operating costs decrease when the system is designed to take advantage of low night time electrical rates and has the flexibility to adjust to changes in peak electrical rates with deregulation. Demand charges can make daytime energy costs as much as six times greater than night time energy costs. With the switch over to deregulation, on-peak daytime energy rates are expected to increase significantly while night time rates are expected to remain flat or decrease.

These attractive first cost and operating cost benefits are being realized in a wide variety of building types, as exemplified by the installations listed below.

CONVENTION CENTERS



Comfort-Link Plant 1, Baltimore Convention Center, Baltimore MD
Ice Thermal Storage



49,055 Ton Hours (172,477 kWh)
4,086,280 lbs. of ice (1,853,537 kg)
also Evaporative Condensers and Cooling Towers



SPORTS COMPLEXES

Sports complexes are ideal applications for ice storage due to large peak loads of short duration.



First Union Center, Philadelphia PA



First Union Center, Philadelphia PA
9,500 Ton Hours (33,402 kWh)
791,350 lbs. of ice (358,956 kg)
also Cooling Towers



Northwind Houston, District Energy Center Union Station, Houston TX
Ice Thermal Storage
44,000 Ton Hours (154,704 kWh)
3,665,200 lbs. of ice (1,662,535 kg)
also Cooling Towers and Evaporative Condensers



Miami Heat Basketball Arena, Miami FL
Ice Thermal Storage
17,280 Ton Hours (60,756 kWh)
1,439,420 lbs. of ice (629,921 kg)



Alamodome, San Antonio TX
Ice Thermal Storage
19,300 Ton Hours (67,859 kWh)
1,607,690 lbs. of ice (729,248 kg)



PSINet Football Stadium (Ravens), Baltimore MD
Ice Thermal Storage
13,600 Ton Hours (47,818 kWh)
1,132,880 lbs. of ice (513,874 kg)
also Cooling Towers



HOSPITALS



John Peter Smith Hospital, Fort Worth TX
Ice Thermal Storage
14,800 Ton Hours (52,037 kWh)
1,232,840 lbs. of ice (559,216 kg)
also Heat Exchangers and Cooling Towers



University of Maryland Medical System,
Baltimore MD
Ice Thermal Storage
9,580 Ton Hours (33,683 kWh)
798,010 lbs. of ice (361,977 kg)



Union Memorial Hospital, Baltimore MD
Ice Thermal Storage
7,210 Ton Hours (25,315 kWh)
599,760 lbs. of ice (272,051 kg)



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COLLEGES AND UNIVERSITIES



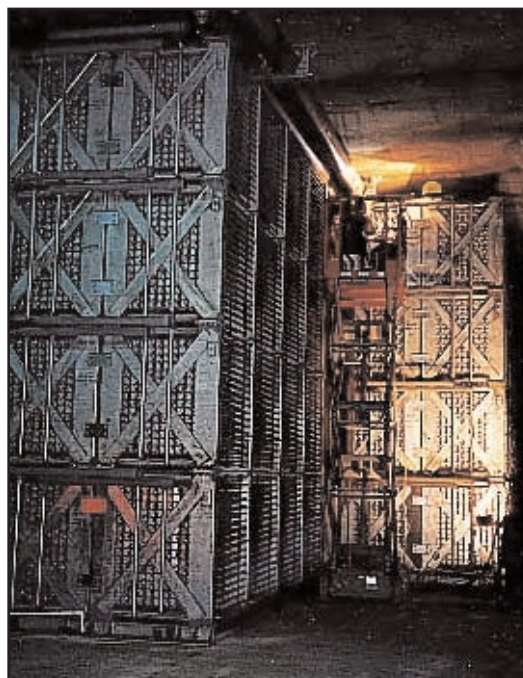
University of Pennsylvania, Philadelphia PA
Ice Thermal Storage
22,000 Ton Hours (77,352 kWh)
1,832,600 lbs. of ice (831,267 kg)



Johns Hopkins Applied Physics Lab, Laurel MD
Ice Thermal Storage
22,400 Ton Hours (78,758 kWh)
1,865,920 lbs. of ice (846,381 kg)
also Cooling Towers



Lee College, Baytown TX
Ice Thermal Storage
5,535 Ton Hours (19,461 kWh)
461,065 lbs. of ice (209,139 kg)



Stanford University, Palo Alto CA
Ice Thermal
93,200 Ton Hours (7,763,560 kWh)
327,691 lbs. of ice
(3,521,551 kg)



HOTELS



Admiral Fell Inn, Baltimore MD
Ice Thermal Storage
1200 Ton Hours (4,250 kWh)
99,960 lbs. of ice (45,342 kg)



Hotel LaReserve, Bellevue Switzerland
Ice Thermal Storage
145 Ton Hours (510 kWh)
12,080 lbs. of ice (4,580 kg)
also Evaporative Condensers



Hotel Saphir, Pontault-Combault France
Ice Thermal Storage
210 Ton Hours (739 kWh)
17,500 lbs. of ice (7,938 kg)
also Cooling Towers and Heat Exchangers



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SUPERMARKETS



Supermarkets have a much higher load during the day than at night, just like office buildings. Ice storage reduces utility bills. The low relative humidity of the air produced with low temperature water reduces or eliminates the need for reheat.

Quinsworth Crazy Prices, Dublin Ireland
Ice Thermal Storage
484 Ton Hours (1,702 kWh)
40,920 lbs. of ice (18,561 kg)

Quinsworth Crazy Prices,
Portlaoise Ireland (not shown)
Ice Thermal Storage
350 Ton Hours (1,230 kWh)
29,155 lbs. of ice (13,224 kg)

AIRPORTS



Midway Airport, Chicago IL
Ice Thermal Storage
14,000 Ton Hours (49,224 kWh)
1,166,200 lbs. of ice (528,988 kg)
also Evaporative Condensers and
Cooling Towers

SHOPPING MALLS



Cosmo Square, Osaka Japan
Ice Thermal Storage
29,300 Ton Hours (103,019 kWh)
2,440,690 lbs. of ice (1,107,097 kg)



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RAILWAY STATIONS

Ice storage solved an electrical supply restriction problem.



Gare St. Jean, Bordeaux France
Ice Thermal Storage
552 Ton Hours (1,941 kWh)
46,000 lbs. of ice (20,865 kg)
also Heat Exchangers

CASINOS

Windsor Casino, Windsor Ontario, Canada
Ice Thermal Storage
8,600 Ton Hours (30,238 kWh)
716,380 lbs. of ice (324,950 kg)
also Cooling Towers

For your next Ice thermal Storage project, choose experience.

With over 2400 successfully operating ice storage installations worldwide, Baltimore Aircoil Company has the application and system experience to assist you in the design, installation and operation of your ice storage system. BAC has supplied ICE CHILLER® Thermal Storage Products for projects that range in size from 90 to 125,000 ton-hours. Installations include office buildings, hospitals, manufacturing processes, schools, sports complexes, supermarkets, casinos, airports, universities, produce storage facilities, hotels and district cooling applications.

BAC's success is a result of its diverse product offering and dedication to research and development. Thermal storage research and product development are conducted in BAC's 25,000 square foot test facility, designed and built exclusively for the testing and development of heat transfer and thermal

storage equipment. Here, research and development engineers test equipment over the broad range of operating conditions encountered in actual use.

The ICE CHILLER® Product line includes a variety of factory assembled units for HVAC and industrial refrigeration projects. For large applications, where space is limited or factory-assembled units are not cost effective, ICE CHILLER® Thermal Storage Coils are available for installation in field-erected tanks.

The BAC product offering provides system design flexibility. Ice can be built using various refrigerants or glycols. They can provide chilled water or glycol to the cooling system. This flexibility, combined with a broad range of application experiences, allows BAC to provide you with a cost-effective product to meet your specific requirements.



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