Saving Energy in the 70s: Bill Holmes' Hometown Ice Arena

By **Bill Holmes, P.E.** February 22, 2013 12:59:56 pm

An outdoor ice skating rink had been built in 1957 in Lincoln Park as a result of a gift to the City of Columbus, Indiana by B.F. Hamilton, founder of Cosco, a children's furniture manufacturer that is still in business today as a part of Dorel. Mr. Hamilton was a neighbor when I was growing up and was on my paper route. I'm not sure if I ever actually talked to him; the rich people could afford to pay their bill once a year at the main office so I didn't have to go to their house every Saturday morning to collect the 35 cents for that week's paper.

My contact with Mr. & Mrs. Hamilton consisted of them always waving as they pulled in or out of their garage in their new Cadillac with the giant tail fins next to where I was shooting hoops with my buddies, rain or shine, day or night, summer or winter. I was in the 7th grade in 1957 and in a small town in southern Indiana, life revolved around basketball. Milan, a school with less than 100 students, had defeated the powerhouse Muncie Central for the State Championship at the Butler Field House in Indianapolis, three years before (the real life "Hoosiers"). And every single one of us thought if we practiced long and hard enough, we could be the next Bobby Plump, who made the winning basket to defeat Muncie.

When the ice rink was built, it gave the whole town something else to do. What a great gift to the community! Originally named after the park where it was located, it was later renamed in honor of the Hamilton Family. After the rink opened, I spent every hour I could skating there with my friends. There was a beautiful warming building with a huge stone fireplace, a skate shop, locker rooms, a snack bar and a large multipurpose room. One of my fondest junior high memories is a Friday night skating party where our band, the Teen Beats, set up in the warming room by the door to the outside rink. The four of us were dressed in our white shirts, black slacks, skinny black ties and red Blazers. With me on the black pearl Gretch drums I had bought with my paper route earnings and our lead guitar, rhythm guitar and piano player, we played Walk Don't Run, At the Hop, Goodness Gracious Great Balls of Fire and Wipe Out with the classic drum solo.

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The 1950s and 60s were a great time to grow up and, it many ways were idyllic – Leave It to Beaver, Ozzie and Harriet – but every once in a while when I look at the picture my mother kept of the Teen Beats, I just see Greg's beautiful smile and think what a waste it was when he went to Vietnam and came back in a box with a bunch of ribbons on his uniform.

Anyway, thanks to Al Gore, the climate began to change, the winters got warmer and the rink's season got shorter and shorter. At some point the community decided to enclose it. I was away in the military when that happened but when I returned in 1974, the outdoor rink had been replaced by the Lincoln Center Ice Arena. The new arena was heated with electricity and the electric bills had risen to the point where this beautiful facility was beginning to be a burden on the community. It had gone from an outdoor rink, with low utility costs and open only a few months a year, to an indoor rink that could be open year-round, but high utility costs were threatening its continued existence.

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Author Bio

Bill Holmes, P.E.

Bill Holmes, P.E. founded Holmes Energy LLC www.holmesenergy.com and developed the AutoPilot Monitoring-Based Commissioning (MBCx) System in 1979. He has a B.S. and M.S. in mechanical engineering and has done additional coursework and research for his PhD. He is a former Purdue professor and taught for several years in the Continuing Education in Energy Management Program at the University of Wisconsin.

Bill has produced savings from 20% to, in a few projects, more than 50% from low-cost, no-cost changes in management, operation, maintenance and control alone in all types of facilities including Industrial Plants owned by Fortune 500 Companies.

He is the recipient of a DOE Award for Energy Innovation and was the Indiana Energy

Bob Kotnik, my mentor at SIECO, the engineering firm where I worked, was friends with Chuck Wilt, the director of the Parks Department, and arranged for us to take a look at the facility to see if we thought we could help. I imagine Bob negotiated a price for a study and report. As the head of the Energy Conservation Department, it was up to me to see what I could do.

The indoor facility had been designed by a firm from Cleveland that specialized in ice arenas. Chuck called a couple of other facilities they had designed to see if they had any suggestions, but found they were all experiencing high utility costs. The new arena included a regulation-size hockey rink plus a smaller practice rink. Four rooftop HVAC units had been installed with electric heaters to heat the facility.

In general, when you see packaged rooftop heating and cooling equipment on a building it is because of their lower first costs. Building a complete building without having to provide space for mechanical equipment is cheaper than providing a boiler room, space for chillers, flues, air handlers, pumps, etc. Build the building first and then bring in a crane to lift the complete mechanical system, packaged HVAC units, onto the roof.

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I suspected that those units may have been there as a result of budget limitations. They may have been the deciding factor in staying within the budget and allowing the building to actually get built. The problem, of course, is that rooftop units are in general harder to maintain, more expensive to operate and have a shorter life than other types of equipment. Sometimes they are the best choice, but not in this case. The result of the decision to compromise, to save money one time, at the beginning of this project was that the owner would have to pay the high operating costs every year for the life of the building. This is very common practice and situation in this country when it comes to building energy systems. The city now had a beautiful facility with rooftop units with electric heaters that they couldn't afford to operate.

I understood the theory; the thermodynamics and the heat transfer, but had never worked in an ice arena before so I had to do a lot of research. The ice in an ice skating rink is made essentially the same way ice is made in your freezer at home; by removing the heat using a refrigeration system. Your refrigerator blows the heat removed into your kitchen. The large compressors or "Ice Machines" in the rink were dumping the heat though a pipe into Hawcreek (this was Indiana), the creek running through Lincoln Park only a couple hundred yards away. And it was a huge quantity of water, millions of gallons a month. It was city water and it was expensive. I measured the temperature of the water and it was warm, in the 80s, as it was carrying all of the heat removed from the ice surface.

The ice machines were the same ones that had been originally installed in the mid-50s. The water was clean, essentially tap water, but it was warm and its effect on the stream was unknown. However, it was hard water, with a lot of calcium, magnesium and iron that created a lime buildup inside of the ice machines and gradually reduced the amount of heat that could be transferred. The buildup had to be removed periodically with acid, which in addition to removing the scale also removed some of the metal and shortened the life of the machines.

I calculated how much heat was being removed from the compressors and dumped into the creek. Wow! It was more than the heat required to heat the new arena. The ice machines were pulling heat from the ice and dumping it into the river, and to replace the heat being removed from the ice, the rooftop units had electric resistance heaters to heat the air. That heat would then travel from the warmer air into the colder ice and then to the creek completing the cycle.

What if that heat could be recycled? Instead of dumping it into the creek, find a way to put it back into the arena instead? Since the waste heat alone was more than the arena needed, the electric heaters could be shut off and a bundle of money saved. And if the solution eliminated using the hard city water, the life of the ice machines could be extended.

The next step was to figure out how to capture that waste heat and put it back into the rink. What equipment would be required? What would the savings be? And how much would it cost for the engineering design and the construction? Following the traditional consulting engineer approach, I did all of the heat transfer calculations to determine the heat in and heat out. I called my college fraternity buddy, Tom Curry, who was a sales rep for Baltimore Aircoil, a company that made the kind of equipment I thought we needed. He was an expert and together we determined exactly what equipment was needed and estimated what the cost would be.

A closed-loop piping system could replace the present one; very similar to the cooling system in your car. A water/antifreeze mixture would be circulated through the ice machines (same as your car engine) to pick up the excess heat, then it would be circulated through water coils that would be added to the rooftop heating units to heat the arena for free. The electric heaters would be off. If there was excess heat left, or in hot weather, the warm water would flow through a large new cooling tower, very similar to your radiator only on a much larger scale. You've all seen them sitting outside of most large facilities, hospitals, industrial and power plants, with a plume of moisture blowing out the top.

Manager of the Year in 1990. He has published numerous papers and been making presentations on his projects and methods for more than 25 years. Bill is a sculptor, a writer and a regular contributor to Sustainable Plant.

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Bob and I wrote up a proposal for the Park Board with all of the information required to make a decision. Apparently it looked good to them, they gave us the go-ahead to actually design the system, prepare the specifications and take bids on building it. I believe the analysis showed that it would pay for itself in a couple of years from the savings, somewhere around a 50% reduction in utility costs. It may have been more; I don't remember the exact numbers. They were saving all of the water and sewer costs plus those resulting from the electric heaters in the rooftop units.

A two-year payback and 50% reduction in utility costs would be attractive to most building owners. The savings would amount to several million dollars over the life of the building. The construction documents were prepared, bids taken and the systems were modified, exactly the way I designed them. They worked great and the utility costs were cut by at least 50%. The arena's future was secure. The community would continue to have this tremendous asset. And it felt really good to have had a major role.

To see how all of the savings from the capital project were lost within 10 years through poor operation and management, see the next installment in this series.

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