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# profile

## Hybrid Electric-Steam Chiller Plant Cools Maryland Basketball Arena

*Comcast Center, the University of Maryland's 470,000-square-foot basketball arena, uses a combination of YORK electric- and steam-drive centrifugal chillers for maximum operating flexibility.*

College Park, MD — The Comcast Center, University of Maryland's $125 million basketball arena, has completed its first year of service to "Terrapin" — the school's team nickname — athletic programs. Among the 470,000-square-foot arena's many innovative design features is a 2,100 TR chiller plant with one electric-drive centrifugal chiller and one steam-turbine-drive centrifugal chiller, each using R-134a refrigerant and each sized at 1,050 TR.

"The ability to use electricity or steam gives me the flexibility I need to manage energy costs. I can change the operating parameters of my chillers based on my real energy costs," noted John I. Vucci, Assistant Director – HVAC Systems, in the university's Facilities Management division, speaking in May 2003.

In addition to the main arena, which seats 18,000 people, the Comcast Center houses athletics administration offices and a 7,000-square-foot Academic Support Center for the school's 700 student athletes on 25 teams. An auxiliary, 1,500-seat gym serves as home to the Terps' volleyball, gymnastics and wrestling teams. A multi-purpose room (capacity 400) is equipped to host banquets, press conferences, large meetings and serve as a pre-game restaurant suite overlooking the competition arena.

Twenty suites provide enhanced viewing and entertainment capabilities for Maryland fans. Students usually occupy about 4,000 seats at a basketball game, ringing the first 10 rows around the floor and a majority of seats on the arena's west wall. Major events, including basketball games, occur in the arena about 100 times a year, mostly during the traditional school year — September through May.

It is this variable, diversified load that engineers had to consider when designing the HVAC system. According to Vucci, thermal-energy storage was considered but ruled out due to anticipated first cost, together with the university's architectural sensitivity to large thermal-storage tanks. Because he already had experience with both steam- and gas-driven chillers, and because steam was available, Vucci encouraged consideration of the hybrid-plant design. His analysis projected a life-cycle operating-cost advantage with the hybrid plant (vs. an all-electric plant), because of an annual energy-cost savings of almost $70,000, a savings of approximately five percent.

The university buys its energy from TriGen, which provides electricity, gas, and steam as well as co-generation capability. Electricity from the co-generation plant is used to base load the campus's power requirement — 18 to 19 megawatts — and reduce the purchase of supplemental power during times of high demand (the campus's peak load is 35 megawatts).

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***John I. Vucci (left), Assistant Director - HVAC Systems in the university's Facilities Management division, reviews operation of the hybrid chiller plant (steam-turbine-drive chiller in background).***

In keeping the co-generation plant operating at peak efficiency, the campus produced excess steam (not needed for heating during warm-weather months). Thus, with steam available for the Comcast Center plant, Vucci planned to operate the steam-turbine chiller as the base-load machine through hot weather, then use the electric chiller to meet cooling loads occurring in the shoulder months — for example, at September basketball games and May's commencement ceremony. However, that operating strategy could shift as energy prices and rate structures evolve.

The hybrid plant is designed in a conventional fixed primary/variable secondary flow arrangement, with 100% variable-flow pumping. The steam-turbine chiller uses steam at 110–120 psi supplied from the onsite Trigen cogeneration system.

Chilled water is supplied at 44°F to a total of 29 air-handling units, all equipped with electronic variable-speed drive. Eight main AHUs serve the basketball arena, each with a capacity of 45,000 CFM. The arena was designed to maintain ventilation airflow at 7.5 CFM per person per hour. This complies with ASHRAE guidelines, because of the short duration — up to three hours — of a basketball game. Overriding this, the ventilation system can supply as much as 100% outdoor air if $CO_2$ levels reach 1200 parts per million in the arena.

With the significant swings in cooling load from hour-to-hour and day-by-day, coupled with the uncertainties in the cost of energy, operating the Comcast Center in the most economical way is a challenge to John Vucci and his team. However, with the adoption of a steam-electric hybrid chiller plant, the team at Comcast Center has the flexibility to meet these challenges…now and in the future.

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