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).
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 CO₂ 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.