Case Study
Pro Player Stadium

Miami, Florida

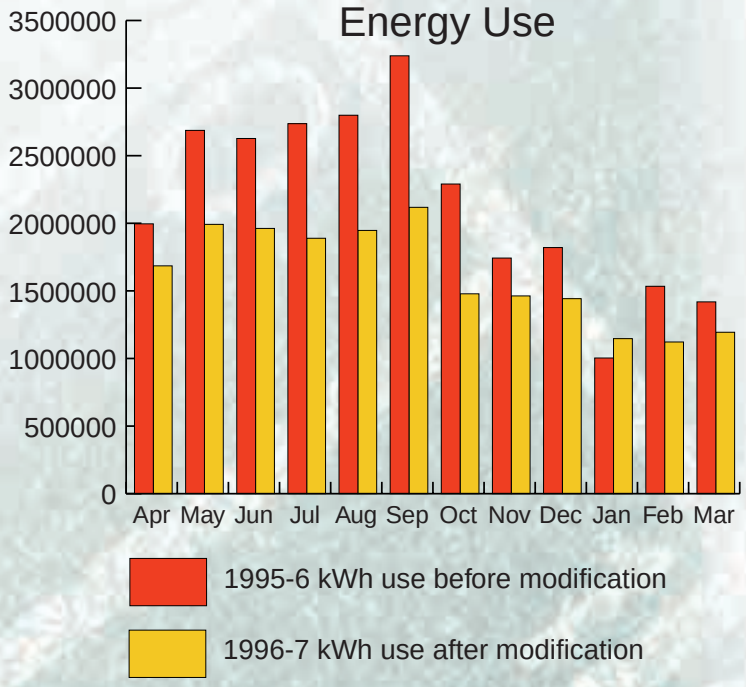
Pro Player Stadium Now Has Cooling and Electrical Capacity to Spare

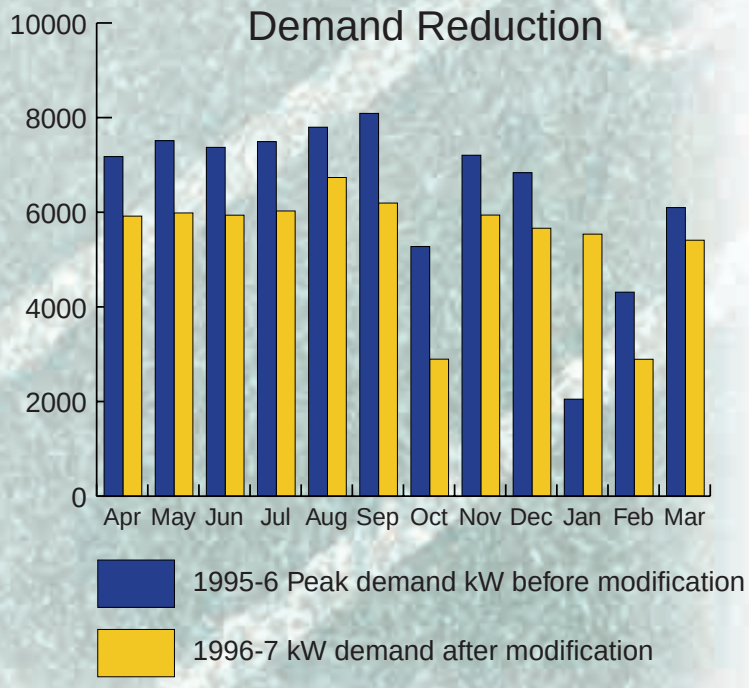
Miami's Pro Player Stadium is one of only a few sites in the U.S. and Canada that host both professional football and major league baseball. In addition to regular league play, the facility, formerly known as Joe Robbie Stadium, has hosted Super Bowls in 1989 and 1995 and is again hosting the Super Bowl in January 1999. It is the only facility to host two collegiate bowl games annually. In addition to sports events, the stadium is used for concerts by such celebrities as Elton John, Gloria Estefan, Hall & Oates and Paul McCartney.

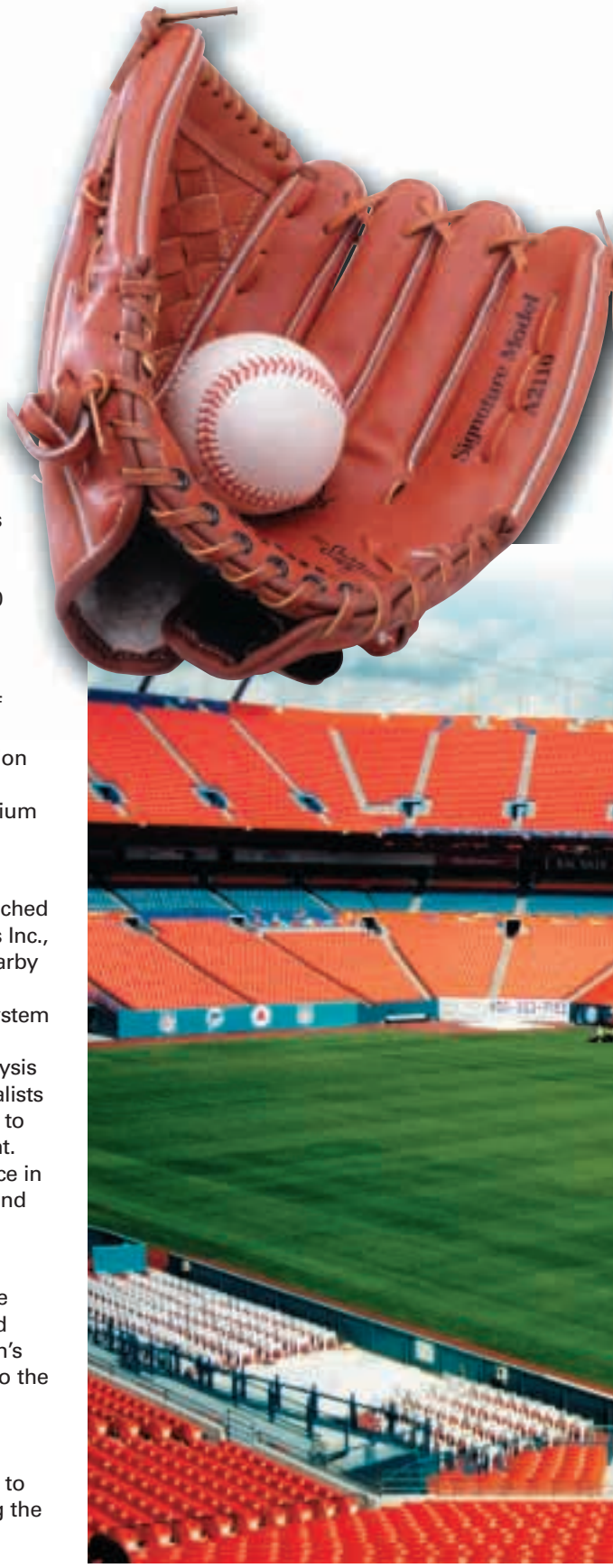
Construction on the facility was completed in 1987. The initial primary purpose of the facility was for home games of the Miami Dolphins professional football team. From the beginning, the facility was designed to also be adaptable to major league baseball. It features baseball seating for 42,000, football seating for 75,000, and has 186 luxury suites for both football and baseball events. Pro Player Stadium has a 270-seat group entertainment center called the Hall of Champions, which can be rented during games as well as on non-event days.

The stadium building includes six theme restaurants as well as the preparation and holding areas for grandstand and luxury box concession services. It includes four locker rooms to accommodate home and visiting teams for both major sports, plus training rooms, team offices and practice facilities. Other facilities include media briefing areas, broadcast boxes and numerous other facilities necessary to support the stadium itself.

Another obvious benefit is the reduction of electric energy requirements. In the first year of operation, kilowatt-hour usage dropped 25 percent from the average of the previous eight years. This alone is a dramatic improvement, but it was achieved along with far better climate control. Building electrical demand has been reduced on an aggregate annual basis by 15 percent – by over 1,000 kW at time of peak usage.







Original HVAC Design Primarily Football

The stadium was designed with an HVAC system intended for the original primary purpose — football. The cooling equipment for the public areas was 14 air-cooled chillers supplying four chilled water systems, serving air handlers for the enclosed concourses, access walkways, and coil units for the vending areas, lounges, luxury boxes and the two floors of the press box.

The balance of the facility, including most of the areas that were occupied year-round, was cooled by ground level air-cooled direct expansion units. These served offices, locker rooms and building service areas. This DX system was in operation virtually year-round. With the use of the facility on a much more intensive basis for the newly-franchised Florida Marlins baseball games beginning in 1993, certain HVAC system shortcomings became more apparent.

It had been feasible to subcool public areas in advance of the relatively few annual football games, but this approach was no longer effective or economical for the baseball season. Part of the problem was that the air-cooled chillers were located beneath the stadium seating overhang, and the warm discharge air from the chiller was entrained back in the building airflow. The upper level outdoor concourses were in this discharge air path and were often even warmer than ambient outdoor conditions.

A second problem was inadequate capacity of both the chilled water and DX systems, particularly on warm days when cooling was needed the most. The South Florida climate is unique in the U.S., with extremely high humidity loads year-round in addition to high temperatures.

In addition, the facility was being operated at negative pressure. This meant that warm, moist outdoor air was constantly being drawn in through openings in the building envelope. This situation increased cooling loads and made comfort levels more difficult to regulate.

Comfort Improvements Needed

In 1994 the owner of the Dolphins and the Marlins, H. Wayne Huizenga, increased his ownership in the stadium from 50 percent to 100 percent. His organization immediately launched a program for improvement and revitalization of the stadium building. One of the areas identified as needing attention was this HVAC system. Huizenga personally listed areas in the stadium needing priority comfort improvements.

The stadium management approached Southeast Mechanical Contractors Inc., a design-build contractor from nearby Hollywood, Florida, to submit a proposal for facility mechanical system improvements. Bill Catron from Southeast directed a detailed analysis of the facility's needs, using specialists to develop alternative approaches to overall HVAC system improvement. Southeast has extensive experience in design and construction of large and specialized HVAC systems in this region of the country.

Southeast performed an extensive analysis of the current system and identified its shortcomings. Catron's evaluation as actually presented to the stadium management included a variety of chiller plant and airside system options. These included adding thermal storage capability to the original chiller plant, replacing the air-cooled chillers with higher

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efficiency water-cooled machines, and adding the new chillers plus ice storage. In presenting and discussing these options with the stadium's ownership, it became clear that the first option was not ideal, because of the deteriorated condition of the original chillers and the problem with the heated air discharge.

Decision to Use Water-Cooled Centrifugal Chillers

Ice storage with new chillers was a viable option, but was not selected because of the space requirement for the ice storage tanks. The decision was made to replace the original air-cooled chillers with two water-cooled centrifugal chiller plants, each plant containing two 750-ton centrifugal chillers. These would provide adequate

Pro Player Stadium was built in 1986.

Chillers were located in previously under-utilized service and storage areas.

An expanded chilled water distribution system was installed to replace an earlier DX cooling system.

Chiller control system features Trane's Adaptive Control™, allowing the chiller to stay on line under adverse operating conditions.

capacity and chilled water temperatures in the low 40's to assure good dehumidification. It was projected that the improved efficiencies of modern water-cooled chillers could reduce the operating cost of the facility significantly as well as improve comfort.

In addition to the chillers themselves, it would be necessary to add cooling towers, preferably at a location away from the stadium to avoid re-entraining warm, moist air. The cooling towers would be equipped with variable speed fan drives to match tower loads to chiller requirements to conserve energy.

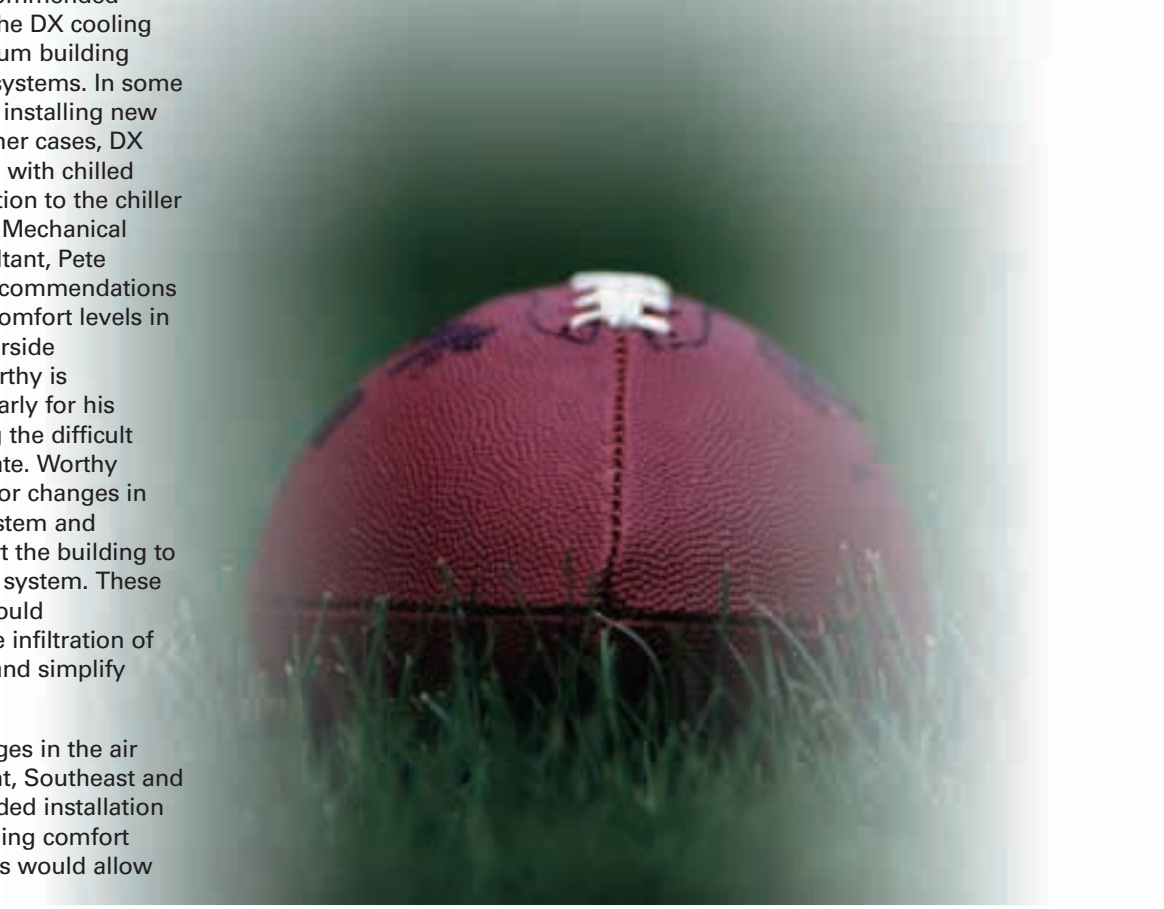
Southeast also recommended replacing most of the DX cooling system in the stadium building with chilled water systems. In some cases this involved installing new fan-coil units. In other cases, DX coils were replaced with chilled water coils. In addition to the chiller options, Southeast Mechanical brought in a consultant, Pete Worthy, to make recommendations on improving the comfort levels in the building with airside improvements. Worthy is recognized particularly for his expertise regarding the difficult South Florida climate. Worthy recommended major changes in the air handling system and ductwork to convert the building to a positive pressure system. These changes, he felt, would dramatically reduce infiltration of moist ambient air and simplify comfort control.

In addition to changes in the air handling equipment, Southeast and Worthy recommended installation of a complete building comfort control system. This would allow air handlers and fan-coils to operate independently to meet local comfort needs. Central control would avoid over-cooling key areas while still managing humidity levels.

The stadium's management accepted the proposal from Southeast and work began Christmas weekend, 1995. The chillers selected were four Trane 750-ton CenTraVac® units. These units were selected for their reputation for reliability and their high efficiency. The units ultimately installed have an ARI efficiency of .531 kW/ton. The new Marley cooling towers were located in stations in the parking area that were landscaped with palms and lower-growing shrubs to blend in with the stadium's tropical setting.

Control System Centralized

The entire facility was tied together with a Trane Tracer Summit® automated control system to optimize comfort in each area and to facilitate system evaluation. This type of unified system control had been lacking in the original system. According to assistant chief engineer Rick Schaffer, the building control system has been programmed for all major stadium events including 81 baseball games, 10-12 football games, auto and RV shows, concerts and smaller events.



Cooling towers in the parking area are screened with palms to fit in with the tropical landscape at the stadium site.

The replacement chiller plant was on line by April 1996, on time for the beginning of the baseball season. The improvement in system efficiency and building comfort were immediately obvious. Schaffer notes that there were areas which had never been effectively cooled. "Right away we could tell the difference." According to Schaffer, the heaviest cooling load is early season football games. "We found out we don't have to subcool the building as we did in the past. The chiller plant can carry the entire load, with capacity to spare. That's a good feeling."

One of the most obvious results of the system replacement is greatly improved comfort throughout the stadium. In all occupied rooms, the temperature and humidity are now both under control, because of the improvements in airflow and system control. The stadium is in the process of repainting and replacing ceiling tile and wallpaper that had been damaged by previous exposure to moisture. They are confident that this exposure is now minimal.

Another obvious benefit is the reduction of electric energy requirements. In the first year of operation, kilowatt-hour usage dropped 25 percent from the average of the previous eight years. This alone is a dramatic improvement, but it was achieved along with far better climate control. Building electrical demand has been reduced on an aggregate annual basis by 15 percent – by over 1,000 kW at time of peak usage.

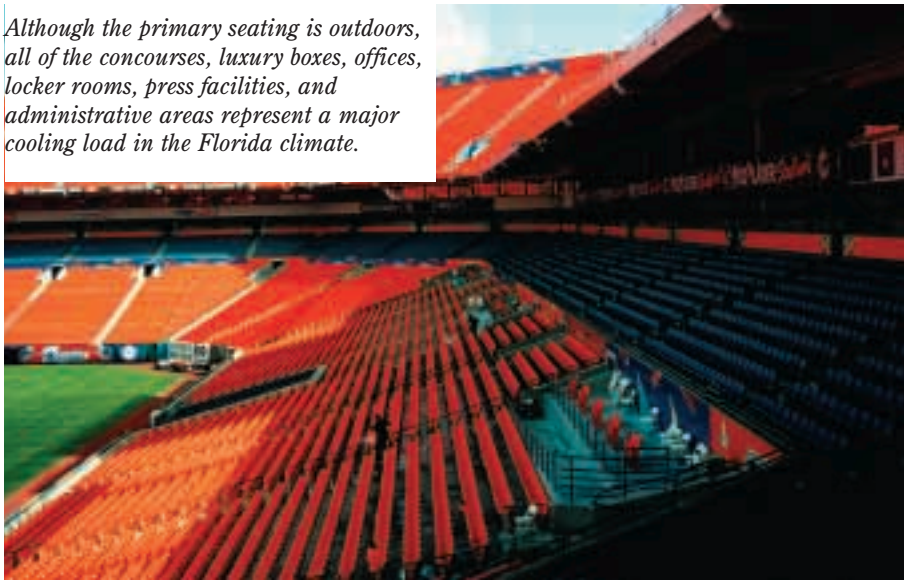
Freed-Up Electrical Capacity a Bonus

According to Schaffer, this demand reduction has paid a surprising dividend. "In the past when we hosted the Super Bowl, the league has required us to supply additional electric generation to meet the special loads for this event. With the 1,000 kW that we've freed up, we've got enough capacity on site to meet their needs. The NFL is very happy with that. In fact, we don't even need to take any equipment offline during the halftime show. This had been our practice in the past."

The area beneath the stadium overhang was formerly a source of heat buildup from the chiller fan discharge.

The savings in energy usage along with the reduction in electric demand charges have provided a project payback of less than three years. And just as importantly, the comfort of customers, employees, even the players, is better than ever. The challenges of the South Florida climate have been met using modern comfort technology.

Although the primary seating is outdoors, all of the concourses, luxury boxes, offices, locker rooms, press facilities, and administrative areas represent a major cooling load in the Florida climate.



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