

Levi's Stadium is the first NFL venue to achieve LEED Gold certification—bringing spectators comfort and delivering efficiency for each game-day challenge.

CASE STUDY

Entertainment

Name

Levi's Stadium, home of five-time Super Bowl Champions San Francisco 49ers and host of 2016's Super Bowl 50

Location

Santa Clara, CA, USA

Building size

1.85 million sq. feet, including 700,000 sq. ft. of enclosed/conditioned/ventilated space

Issue

HVAC solution that meets stringent California energy standards, LEED Gold Certification, and game-day comfort demands

Solution

(21) Daikin water cooled self-contained systems totaling 1850 tons

Daikin Self-contained HVAC Systems Help 49er's Stadium Score LEED Gold and California Title 24 Certification

Issues

HVAC systems for the premier \$1.2 billion Levi's Stadium, home of the San Francisco 49ers NFL football team, needed to meet a number of requirements including energy efficiency and compact design of equipment best suited to the climate.

Levi's Stadium, located about 40 miles south of San Francisco in Santa Clara, creates a unique viewing experience that allows visitors to enjoy views of the field and the surrounding Silicon Valley. The stadium's predominately horseshoe-shaped design takes advantage of the region's micro-climate with an open and airy feel.

LEED Gold-certified, the facility is highly sustainable. More than one-half of building materials are reclaimed or recycled. The suite tower on the west side of the stadium features a 27,000 sq. ft. living, green roof. Three solar bridges, incorporating hundreds of solar panels, connect the main parking area to the stadium, which includes charging stations for electric cars. Additional green features are high-efficiency LED lighting and use of recycled water for playing field irrigation, the green roof, toilets, and cooling tower make-up water.

A world-class sports and entertainment venue, Levi's Stadium accommodates 68,500 people, with expansion capabilities up to 75,000. Two-thirds of seating is located in the lower bowl. The stadium features 165 luxury suites—including 8,500 club seats—and 400,000 sq. ft. of event space.

Fast-track project

Long before stadium construction commenced in April 2012, engineering specialists from general contractor Turner-Devcon Joint Venture (TDJV)

and Daikin manufacturer's representative Norman S. Wright Mechanical Equipment Co. were among the teams that met with the owner, the Santa Clara Stadium Authority.

"Levi's Stadium was a fast-track design-assist project that used a highly collaborative method to design and build the stadium," says Ron Yaffe, vice president of sales at Norman S. Wright in San Francisco.


The South Bay micro-climate and energy performance were chief considerations for mechanical, electrical, and plumbing (MEP) systems.

"Key evaluation aspects for OEMs included reliability, given the infrastructure at the stadium includes fire and security command centers as well as a temporary holding facility (police station). Thermal comfort of the football players and visitor comfort were also considerations," says Chad Johnson, P.E., LEED AP, engineering and commissioning manager with TDJV, in San Ramon, California.

Following feasibility studies by TDJV and the international engineering consulting firm WSP, it was determined a condenser, tower water system for heat rejection of the packaged air-conditioning units and a highly efficient heat pump for the domestic hot water system



Daikin units in the event-level lower mechanical room deliver superior and quiet performance.



was the best HVAC solution for the stadium. Mechanical equipment also had to meet the energy performance requirements of the building's planned LEED Gold certification and the California Energy Commission's Title 24 Building Energy Efficiency Standards.

"The entire HVAC system was specified as variable flow with enhanced controls to optimize the performance and improve energy savings. The ventilation system was specified as centralized, variable air volume (VAV) with airside economizer," Johnson says, adding, "As part of the energy modeling, the equipment and system evaluation was critical because of the unique peak demand of event days, such as football games and concerts, versus non-event days and private events with a low number of occupants."

Solution

Daikin water-cooled self-contained air conditioning units (AC) were the clear choice given the OEM's ability to comply with the equipment specifications and "required on job" dates. "While commercial grade air-conditioning equipment was the engineering baseline, the flexibility of OEMs was important to incorporate pre-heat coils, air flow measuring stations, and control interfaces such as smoke control," Yaffe says, adding, "The efficiency of the Daikin self-contained units and the refrigerant specifications exceeded the minimum requirements for Title 24 standards."

Daikin supplied 21 large-capacity AC units in a compact design. "Equipment room space was at a premium both in the belly of the stadium and in the upper luxury suites and office areas, so one goal was to meet the cooling needs with as few self-contained AC units as possible. The Daikin units were sized up to 100 tons each, which enabled the designers to save space in the equipment rooms by having fewer units," Yaffe says.

The Daikin self-contained AC units were semi-customized to include pre-heat coils for winter conditions. Yaffe says: "Normally, the hot water coils would be ordered separately. For this project, the Daikin engineers were able to insert the hot water coil into the standard cabinet which was space saving." Low noise was also a requirement given some of the stadium mechanical rooms are located near occupied spaces. Notably, the plenum fans on the Daikin AC units generate less noise than similar models of other manufacturers.

Turnkey, design-build project

To speed the construction effort, Levi's Stadium was developed in a sequenced plan for logistics, stocking, and installation. The facility was built as three independent projects running concurrently: suite tower section, bowl side (main and upper concourses), and event level (lower bowl). "The construction sequence was incorporated as part of the engineering efforts to avoid start-up issues, given the common ductwork and piping systems between the suite tower, bowl side, and event level," Johnson says.

ACCO Engineered Systems performed the installations of sheet metal, piping, and HVAC systems, maintaining cleanliness in compliance with LEED indoor air quality (IAQ) credit. In keeping with the project's design-assist model, Daikin was among the OEMs that collaborated with the design team. "Daikin worked closely with ACCO by providing 3-D CAD files of the 100-ton water-cooled air conditioning units to assist with the modeling of the equipment rooms, ductwork, and piping systems. The modeling and design efforts made for a smooth installation process," Yaffe says.



The stadium was constructed with the environment in mind: more than half of the materials are reclaimed or recycled and the Daikin units were chosen for their efficiency.

Building the stadium required complex sequencing among various trades. ACCO alone employed 125 engineers and field personnel to design and install 875,000 tons of sheet metal and miles of condenser and hot-water piping. Deliveries of materials and equipment, including pre-assembled ducts and piping components, were made on a just-in-time basis, with multiple daily transfers made to the jobsite from a nearby receiving yard.

"Building the stadium super-structure (including the 'topping of steel') was achieved in nearly four months and completed by the end of 2012, allowing the associated mechanical rooms to be readied for equipment," Johnson says. Ductwork fabrication began in 2012 and ductwork installation was completed over the course of several months in 2013. During first quarter 2013, the Daikin self-contained units were installed throughout the stadium, including in lower-level mechanical rooms.

Commissioning and operations

As part of the ventilation system start-up, local and factory Daikin technicians were on-site to verify the packaged air-conditioning unit controls. Work included preparing the interfaces to the stadium's building automation systems (BAS), firmware updates, and operational settings among numerous HVAC applications. "Start-up and commissioning efforts began in summer 2013 to ensure the entire construction and operations teams were synced for a successful delivery of MEP, various BAS, and food service systems," Johnson says. Systems were operational in time for the stadium's soft-opening event in April 2014 to include commissary and other early move-in spaces.

Outcome

After a record-setting and fast-tracked building process—construction was completed within two and one-half years from the bid date—Levi's Stadium opened for the first pre-season 49ers game during August 2014. Levi's Stadium received LEED Gold Certification for Building Design and Construction of a new facility in 2014 and is the first stadium to host an NFL team with the distinction. Visitors can view a live dashboard display, located inside the stadium near the 49ers Museum, featuring current energy measurements, water and air monitors, and other dynamic green features.

Since the stadium opened, it's all systems go for the Daikin HVAC equipment. "After the inaugural season in 2014, HVAC systems were re-evaluated versus the energy modeling and the Daikin self-contained units performed as specified," Johnson says.

On February 7, 2016, Levi's Stadium was the proud host of Super Bowl 50 and accommodated nearly 72,000 visitors.