200 Clarendon Street
Boston, Massachusetts

GREENING AN ARCHITECTURAL LANDMARK

Boston Properties develops and implements of a long-term capital improvement strategy for an architectural landmark in Boston

200 Clarendon Street, formerly known as John Hancock Tower, is a 62-story Class A office building located in the heart of Boston's Back Bay neighborhood at Copley Square. Designed by Henry Cobb and I.M. Pei, 200 Clarendon Street was completed in 1976. As New England's tallest building, the 790 foot iconic tower is a celebrated architectural landmark.

In late 2010, Boston Properties purchased 200 Clarendon. While the image and architectural beauty of the building remains timeless, the mechanical systems, original equipment installed in the late 70's and almost 40 years old, were in dire need of modernization.

Boston Properties spent the next year developing a multi-year capital improvement plan to replace the building mechanical systems and controls, with a goal of reducing energy consumption, elevating thermal comfort and sustainability performance, and maximizing the potential for tenant retention.

The modernization program consists of complete retro-commissioning of mechanical systems and four primary projects: Chiller Plant Reconstruction, Heat Exchanger Addition, Condenser Water Loop Optimization and Energy Management System (EMS) Enhancement.

Chiller Plant Reconstruction

The existing 2,750 ton plant included three inefficient 1970's-era chillers equipped with constant speed pumps and manual controls. Reconstruction of the chiller plant included: replacement of the existing chillers with new high efficiency York centrifugal chillers, the addition of variable speed drives (VSDs), new high efficiency chilled water and condenser water pumps with VSDs and new programming and controls allowing chilled water and condenser water temperature resets.

Heat Exchanger Addition

The fully-glazed southern façade of the building creates challenging solar heat gain exposure during the winter months when the northern zones require heating while the southern zones simultaneously require cooling to overcome radiant heat from the sun. It was common to operate a constant speed 1,000 ton chiller to provide cooling to the perimeter induction units during the heating season. Large plate-and-frame heat exchangers were added on the 7th and 62nd floors to allow the building to enter an 'economize' mode, utilizing free cooling when the outside air temperature is below 55° F.

Condenser Water Loop Optimization

The existing condenser water loop system allowed unrestricted constant-volume condenser water flow for tenant and building supplemental cooling systems. Optimization of the system included the addition of

"Our objective is to invest in the systems of 200 Clarendon Street in ways which enhance the building's sustainability, efficiency and comfort. We want the experience inside the building to be commensurate with the expectations you have when you see it from the outside."

- Doug Linde
President
Boston Properties

"Before the improvements, it was like we were trying to fly with a submarine."

- Jack Shea
Regional Engineer
Boston Properties

Boston Properties

two-way valves to regulate flow and a cooling tower retrofit that resulted in a delta-T increase, meaning less water is needed to pump through the system at any given time. As a result of the optimization, the amount of cooling capacity available for tenant and building systems has doubled with the same flow and cooling tower equipment, all while reducing energy consumption and operating cost.

Energy Management System (EMS) Enhancement

Over the years, the EMS had been randomly programmed and manually adjusted to troubleshoot heating and cooling system deficiencies. Many of the sensors had never been replaced, and the equipment had drifted out of calibration. EMS improvements include programming of a universal sequence of operations, retro-commissioning, inspection and calibration of all equipment and sensors, installation of new air flow monitoring stations and CO_2 sensors to modulate the intake of outside air to meet demand and complete modernization of the system user interface graphics.

Improved Performance Outcomes

The development and implementation of a long-term capital improvement strategy that aligns financial and sustainability goals is paying off. In 2014, energy consumption in the building was down 7.5%, resulting in an energy cost savings of $665,000.

With the implemented energy conservation measures and retro-commissioning fully stabilized, the project will improve thermal comfort and yield a combined annual energy savings of 3.3 million kWh per year – over 9% of the building's electrical consumption – enough energy to power 438 homes in Massachusetts, or to offset the CO_2 emissions produced by the combustion of 256,000 gallons of gasoline.

A much greener architectural landmark is on track to earn the ENERGY STAR label and Leadership in Energy and Environmental Design (LEED) for Existing Buildings certification for the 2016 performance period.

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