



Case Study

Singapore's iconic shopping mall vied Green Mark Platinum Awards and revamped its chiller plant system

Summary

One of the oldest and most iconic buildings along Singapore's premier shopping district underwent a green retrofit of their chiller plant system to become 54% more energy efficient, saving the owners an estimated SGD\$1 million per year.

The Story

Lucky Plaza is a 30-storey commercial / residential mixed development situated along Singapore's premier shopping district - Orchard Road. Built by developer Far East, it has proven to be one of the most successful shopping centers since its opening in 1979. The mall comprises a mix of over 600 retail shops, medical centers and food and beverage establishments, and residential apartments. It has a gross floor area (GFA) of 46,800m² and about 80% of it is air-conditioned.

In 2014, Lucky Plaza underwent a green retrofit to its chiller plant system and Johnson Controls was appointed the Energy Services Company (ESCO) and Green Building Consultant.

Demonstrating leadership by embarking on a Green Retrofit for their old building

Although the building is 35 years old, it did not deter the owners from demonstrating leadership to embark on a green retrofit.

Through an energy audit of their chiller plant system, the energy team from Johnson Controls discovered that the system's average operating cooling load was 1,150 RT and the chiller plant efficiency was 1.25 kW/RT, which is considered inefficient by current industry benchmarks. The chillers were also installed with traditional chiller plant controls and inefficient, complicated piping design. In addition, the internal components of the cooling towers were deteriorated and the in-fills were deformed and scaled.

Following on, the energy team then designed a 3D model of the Chiller Plant using a Computer Aided Design (CAD) and evaluated the engineering design by studying the energy efficiency implications on various equipment, piping and system design. Through these series of tests, the energy team finalized the solution that gave the optimal energy efficiency and it was readily accepted by the management of Lucky Plaza.

The chiller plant was right-sized and optimized - the three existing aged 900 RT chillers were replaced by three high efficiency YORK® 700 RT chillers. In addition, the capacity of the chilled water pumps, condenser water pumps and cooling towers were reduced and piping was improved through enhanced engineering design. The water treatment system for the cooling towers has 7 cycles of concentration or better, making it more efficient.

Case Summary

Customer Challenges:

- To undergo a green retrofit on its aging systems
- Inefficient chiller plant efficiency operating at 1.25 kW/RT
- Chillers installed with traditional chiller plant controls and inefficient, complicated piping design
- To monitor and manage building operations efficiently

Our Solution:

- Evaluated current engineering design by studying energy efficiency implications on various equipment, piping and system design
- Replacing aging chillers with three high efficiency YORK® 700 RT chillers
- Reduced capacity of chilled water pumps, condenser water pumps and cooling towers and improved piping design
- Installed Metasys® Building Management System, VSDs, automatic tub cleaning system and M&V system to accurately monitor chiller plant efficiency
- Installed UV-C emitters to AHUs to improve air quality and eliminate coil washing
- Implemented green features and energy policies to cultivate green practices among the tenants

Customer Benefits:

- Impressive improvement of average chiller plant efficiency to 0.572 kW/RT
- Greatly reduced overall building energy consumption by 38%, bringing an estimated annual energy savings of close to SGD\$1 million
- Reduction of carbon dioxide emissions of approximately 2,220 tons per year
- Improvement of indoor air quality, resulting in enhanced occupant satisfaction that will contribute to improved productivity
- Awarded BCA Green Mark Platinum Certification

Furthermore, the owners were able to conveniently monitor and control their chiller plant with the installation of the Johnson Controls Metasys® Building Management System. Various components were also installed to improve the chiller plant system efficiency and performance, such as Variable Speed Drives (VSDs) and Automatic Tube Cleaning System. As part of legislative requirements, a Measurement and Verification (M&V) system which complied with the SS591 code was also installed to accurately monitor the chiller plant efficiency.

To improve the indoor air quality and eliminate coil washing involving the use of less environmentally friendly chemicals, Ultraviolet C (UV-C) emitters were installed to the Air Handling Units (AHUs). High efficiency air filters with Merv 13 Rating were also installed to the AHUs.

Additional green features were also implemented, such as waste management system, motion sensors along staircases, and developing of energy policies to cultivate green practices among the tenants.

Reaping the benefits of a Green Retrofit

With the green retrofit solutions delivered by Johnson Controls, the average chiller plant efficiency had an impressive improvement of 54%, from 1.25 kW/RT to 0.572 kW/RT. The overall building energy consumption was also greatly reduced by 38%, bringing an estimated annual energy savings of close to SGD\$1 million. In addition, there was a reduction of carbon dioxide emissions of approximately 2,220 tons per year. The indoor air quality was improved, creating a high quality indoor environment resulting in enhanced occupant satisfaction that will contribute to improved productivity.

In February 2015, Lucky Plaza was awarded the prestigious Building and Construction Authority (BCA) Green Mark Platinum Certification. This award distinguishes Lucky Plaza as a benchmark for green retrofits of existing old buildings.