Building Automation System Retrofit Case Study

Baseline

D Building at Parkland College, located in Central Illinois, is a 99,407 square foot, 3-story structure. It was opened in 2002 and contains offices and classrooms, with a design occupancy of 1050 people. The HVAC control was provided by the original building automation system (BAS). The building's chilled water is provided by the campus chilled water system located in a remote mechanical building and the hot water is provided by two hot water boilers located in the lower level of D Building. The air distribution is provided by four air handlers and one hundred and twenty variable-air-volume (VAV) boxes. The building's exhaust is provided by ten exhaust fans with only one, EF1, being controlled by the BAS.

Quick Glimpse	
Customer	Parkland College
Measures Implemented	Controls System Upgrade
Total Project Cost	$219,289.00
Estimated Annual Energy Savings for the building	118,627 kWh 29,541 Therms
Estimated Annual Energy Savings of Chiller Plant	380,368 kWh
Estimated Annual Cost Savings	$47,796.00
Ameren Incentive Received	$75,369.41
Estimated Payback	3 years

Impact 599 Acres or 57,330 Gallons or 108.2 Cars

*Project impact calculated using the EPA Greenhouse Gas Equivalencies Calculator

Problems

Parkland College knew that the existing HVAC mechanical and control systems would not allow them to achieve their sustainability and energy reduction goals. They reached out to Ruyle Mechanical Services/Environmental Control Solutions, Inc. (ECSi) for help with a campus wide retro-commissioning survey. The initial walk-through revealed many energy saving opportunities that needed to be addressed before a retro-commissioning project would be beneficial. D Building's BAS was allowing its equipment to run continuously 24/7/365, at 100% capacity. The system's components were no longer produced or supported by the manufacturer. Access to replacement parts and refurbished controllers was extremely limited. In addition, the main air handler chilled water control valves were system dependent type valves that were not maintaining constant flow.

Solutions

A phased approach addressing mechanical and control issues was mutually agreed upon. Ruyle Mechanical Services / ECSi developed a prioritized list of proposals adhering to Parkland College's sustainability and energy efficiency goals, based on the current energy efficiency codes and standards. Following is a list of projects that have been approved and completed in D building:

1. Replacement of the BAS with an Automated Logic Controls BAS system on 4 main air handling units, 120 VAV boxes, 2 boilers and 1 chilled water tertiary pump.
2. Replacement of the 4 system-dependent chilled water control valves on the 4 main air handling units with system-independent type valves.
3. Installation of BAS on Exhaust Fan 1 (All Restrooms).

Results

1. The new Automated Logic Controls (ALC) system provides detailed scheduling of occupied/unoccupied times for the HVAC equipment during which the spaces' temperatures can be set back for optimum energy efficiency.
2. The installation of the ALC system on the 4 main air handlers provides reset type control of the supply air's temperature and volume by controlling the speed of the blower motor, damper positions and chilled water control valves to provide the air distribution system with properly conditioned air for optimum energy efficiency.
3. The installation of the ALC system on the 120 VAV boxes provides reset type control of the hot water reheat control valves and the volume dampers. This will control the temperature and volume of the air supplied by the VAV boxes to within the guidelines of the current energy efficiency codes and standards and maintain acceptable comfort levels in the building.
4. The installation of the ALC system on the 2 hot water boilers will provide a Lead/Standby operating sequence to eliminate both boilers running at the same time since one boiler can handle the heat load of the building.
5. The installation of the ALC system on the hot water boiler system and the tertiary chilled water pump will enable the water temperatures to be reset to provide hot water and chilled water within the guidelines of the current energy efficiency codes and standards.
6. The installation of system independent chilled water control valves will result in precise flow of chilled water to the main air handlers' coils during fluctuations of the campus chilled water loop's pressure as the cooling demand increases and decreases. This allows control of the main air handlers' supply air temperature within the guidelines of the current energy codes and standards.
7. The installation of the ALC system on EF1 provides the ability to schedule Occupied/Unoccupied times for the restroom exhaust system.

Notes

1. The projects were completed in December 2018.
2. The estimated savings are based on building modeling software calculations.
3. The actual electric savings for the building from January to June 2019 is 125,729 kWh.