Presence Saint Joseph Medical Center

Retro-Commissioning

Facility Data: Presence Saint Joseph Medical Center was built in 1962 in Joliet, IL, and has grown to encompass nearly 1.2 million square feet of facilities, with 480 licensed beds. Areas of concentration include neuroscience, advanced cardiac care, orthopedics, obstetrics, rehabilitation, and a trauma center.

Scope of Project: The facility was retro-commissioned in 2013-14 as part of the ComEd Smart Ideas Incentive Program. The intent was to identify and implement low-cost, short-payback energy conservation measures to improve sustainabiltiy and reduce annual operating costs.

Project Cost: $32,341

Project Summary:

Primary heating for the campus is supplied by four steam boilers totaling 2,050 boiler horsepower. Pressure-reducing valve stations and hot water converters are located in mechanical rooms throughout the facility. Steam is used for the kitchen, sterilizers, and almost all air-handling unit heating coils. Hot water is used for a couple of AHU heating coils, terminal unit reheat coils, baseboard hot water heat, radiant heating panels, and fan coil units.

The chilled water system is variable secondary with a constant primary served by four water-cooled, electric centrifugal chillers and two air-cooled chillers. The total cooling capacity is 4,100 tons. Cooling is provided year-round.

PSJMC's ventilation system has about 35 AHUs, ranging from 1960s vintage to recently installed units. The mix includes constant volume and variable volume units, 100% outside air and recirculating units, and pneumatically controlled and digitally controlled units.

Retro-Commissioning Measures

During planning and investigation, eight retro-commissioning measures (RCMs) were presented to the hospital. The two measures chosen for priority implementation focused on improving efficiency of 13 air handling units.

The majority of the energy savings resulted from ***reduction of simultaneous heating and cooling*** that was occurring in four large AHUs. These units were only four years old, but the steam control valves had failed prematurely. The affected AHUs had two steam valves apiece; one was failed open on each of the four units. The cooling valves were compensating for the additional heat, and the unit discharge air temperature was normal. Temperature sensors were not installed downstream of the preheat coil, and the building automation graphics showed the valves were being commanded closed, so the failure was not evident from the controls system.

Grumman/Butkus Associates identified the valve failure, concluding that the electro-hydraulic steam valve actuators had overheated due to the size of the steam lines and the proximity of large isolation valves. The client implemented the recommended cost-effective solution: replacing actuators and insulating the control valves. The other nine AHUs had less severe issues. Most of these units had pneumatic actuators that needed calibration to drive the valve completely closed when it was commanded to do so.

The second implemented measure addressed ***supply fan speed control***. Four VAV air handling units were operating with the supply fans at constant speeds because of various issues. Failures were identified in a variable frequency drive, a static pressure sensor, a controls electro-pneumatic transducer, and a controls analog-input module. These issues have since been remedied.

Six additional RCMs were identified through RCx but have not yet been implemented:

- Installing new chilled water differential pressure sensors to improve chilled water pump control.
- Modifying the economizer control sequence to utilize more outside air for free cooling.
- Implementing static pressure reset control sequences.
- Scheduling an air handling unit that served transiently occupied space.
- Repairing snow/ice sensors that are used to control a snow-melting system.
- Optimizing the cooling setpoint for one underperforming AHU.

Several extra capital measures to reduce energy consumption were also suggested, including: converting the hot water portion of the heating system to variable flow; reducing the airflow for operating rooms based on occupancy schedules; installing variable frequency drives on the boiler burners and kitchen exhaust fans; and converting single-zone air handling units to variable air volume. These suggestions offer guidance for improving the campus' long-term energy efficiency.

Innovative Features

Although the implemented measures don't suggest an extreme degree of innovation, the additional measures represent creative application of modern energy efficiency strategies, with significant impact to operating costs as well as overall carbon footprint.

Results

Energy and cost savings calculations were developed by G/BA and were reviewed by the ComEd RCx program administrator and a third-party service provider. In general, reducing simultaneous heating and cooling resulted in modeled annual electrical energy savings of over 1.8 million kWh and natural gas energy savings of 446,559 therms. Modeled annual electrical energy savings for solving supply fan problems were 101,475 kWh. Implementing all six remaining RCMs would result in modeled electrical energy savings of 417,726 kWh/yr and natural gas savings of 12,566 therms/yr.

ComEd paid 100% of the engineer's RCx fee, allowing PSJMC to conserve finances for the implementation. Of the eight suggested RCMs, the client selected the two most cost-effective, both of which had a very short simple payback time (0.08 year for eliminating simultaneous heating and cooling and 0.27 year for correcting supply fan controls). The total cost savings resulting from these two measures exceed $330,000/yr ($134,409 for electricity and $205,417 for gas). The client expects to implement more RCMs in future months. If all six remaining RCMs were implemented, annual additional cost savings would be nearly $26,000 for electricity and over $5,700 for natural gas. Payback ranges from 1.13 years (snow-melt system repair) to 6.83 years (airflow scheduling).

Retro-Commissioning Measures, Energy and Cost Savings, and Payback

RCM No.	Measure Description	Peak Demand Savings (kW/mo)	Electrical Energy Savings (kWh/yr)	Electrical Cost Savings ($/yr)	Natural Gas Energy Savings (therms/yr)	Natural Gas Cost Savings ($/yr)	Implementation Cost ($)	Simple Payback (years)
1*	Eliminate simultaneous heating and cooling	0	1,842,887	$114,259	446,559	$205,417	$27,001	0.08
2	Chilled water pumping optimization	0	190,761	11,827	0	0	23,290	1.97
3	Economizer optimization	0	102,363	6,347	0	0	18,266	2.88
4	AHU static pressure reset	7	101,475	6,291	0	0	10,745	1.71
5	Airflow scheduling	0	9,926	615	552	254	5,940	6.83
6*	Supply fan control corrections	0	325,008	20,150	0	0	5,340	0.27
7	Snow-melt system control	0	5,259	326	12,014	5,527	6,600	1.13
8	AHU-568 cooling setpoint optimization	0	7,942	492	0	0	1,485	3.02
*Verified totals for implemented projects (Nos. 1 and 6)		0	2,167,895	$134,409	446,559	$205,417	$32,341	0.10
Totals for all identified measures (implemented and not implemented		7	2,585,621	$160,307	459,125	$211,198	$98,667	0.27

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