Center for **Energy**
and **Environment**

Recommissioning of an Extended-Care Mental Health Facility

The extended-care mental health facility recommissioned is a four story building with a conditioned area of 37,300 sq.ft. (Figure 1), built in 1962. The building receives steam from a district steam plant and chilled water from a central campus plant. Steam-to-hot water converters supply hot water to reheat coils and perimeter radiation. Two major air handling units (AHUs) provide conditioned air at constant volume 24 hours per day to terminal reheat induction boxes in patient rooms and offices and ceiling mounted terminal boxes serving nurses' stations. The campus has a modern building automation system (BAS), with supervisory control and unitary local controllers.

Figure 1: Front view of extended-care mental health facility.

Objectives and Approach

The owner's objective for the recommissioning project was to reduce energy costs with an attractive payback while maintaining or improving indoor air quality and comfort. To conduct this project, the first of several on a large health-care campus, CEE partnered with the Energy Systems Lab at Texas A&M University, the most experienced and effective health-care recommissioning provider in the U.S. The recommissioning team provided the diagnostic work, detailed engineering and technical supervision, selected BAS programming, and measurement and verification. At the owner's request, the project made use of in-house operations and maintenance staff to implement most of the mechanical and electrical work and BAS programming, reducing external costs and giving the operators an opportunity to develop a deeper understanding of the systems they operate and maintain.

Major Recommissioning Measures

Diagnostic measurements were carried out by highly-skilled and experienced engineers to quickly zero in on key opportunities. The recommissioning measures implemented are shown in Table 1. The building was found to have excessively high total supply air flow and a constant year-round supply air temperature. This, combined with overpumping of the reheat system, worn and leaky reheat valves and minimal reheat reset led to a significant degree of simultaneous heating and cooling. The high total supply air flow and mismatch of the supply and return fan speeds also led to excessive outdoor air flow that both wasted energy and caused persistent tripping of the freeze-stat in winter. Modifications in central-system operation and control were coupled with resolution of zone level problems to allow operation to be optimized. The most important zone-level work was the replacement of damaged seat rings in numerous zone valves and cleaning of the perforated plates that serve as nozzles for primary air in the induction units.

Table 1. Recommissioning Measures Implemented at the Health Care Facility

Measures and Details
1. Reduce total supply air flow a. Change supply and return motor sheaves to reduce fan speed. b. Follow up with necessary fixes to maintain comfort.
2. Reduce outside air flow a. Reduce fan speeds and properly match supply and return speeds b. Repair outside air dampers and actuators c. Readjust minimum outside air damper position based on measured outside air flow
3. Reset supply air temperature with outside air temperature a. Replace constant temperature pneumatic controller with unitary controller tied into existing supervisory control. b. Switch from constant supply air to reset c. Follow up with necessary fixes to maintain comfort.
4. Automate and increase reset of reheat water temperature with outside air temperature, reduce reheat water flow rate. a. Switch from manual reset to deeper automated reset, using points on existing unitary controller. b. Choke reheat pump flow with manual valve.
5. Automatically cut out perimeter radiation using spare points on existing unitary controller.
6. Implement zone-level fixes to assure comfort a. Repair leaking reheat valves. b. Clean nozzle plates in induction units. c. Calibrate thermostats d. Spot-balance air flows

Savings, Costs and Payback

The project achieved annual savings of $45,412. The total cost was $40,146 (of which $10,000 were internal costs), giving a payback of 0.9 years prior to the Xcel Energy rebate (Table 2). Xcel Energy provided a rebate of $200 per summer peak kW saved, or $11,000, reducing the payback after rebate to 0.6 years. At this writing, two larger projects are currently underway on the same health care campus.

Table 2. Savings and Costs for the Health Care Facility

Savings					
End Use	Source	Electricity (kWh/y)	Demand (kW/mo)	Steam (10^6 Btu)	Dollars
Fan	Spot measurement of true power before and after resheaving (24 hour per day constant volume system)	218,124	24.9		$10,906
Chiller	Bin calculation based on change in supply air flow rate and temperature	114,000	33.4		$5,700
Radiation pump	Estimated	1,300			$65
Reheat	Calculated by bin analysis based on short term measurements with ultrasonic transit time flow meter			3,770	$28,841
Total		333,424	58.3	3,770	$45,512
Costs					
Equipment and Materials					$10,850
Engineering					$19,296
In-house labor					$10,000
Total					**$40,416**

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