CHAPTER/REGIONAL TECHNOLOGY AWARD - SHORT FORM

1. Category (Check one and indicate New or Existing, if applicable)

○ Commercial Buildings	○ New or ○ Existing	
Institutional Buildings:		
○ Educational Facilities	○ New or ○ Existing	
○ Other Institutional	○ New or ○ Existing	
● Health Care Facilities	○ New or ● Existing	
○ Industrial Facilities or Processes	○ New or ○ Existing	
○ Public Assembly	○ New or ○ Existing	
○ Residential (Single and Multi-Family)		

2. Name of building or project: University of Chicago Duchossois Center for Advanced Medicine

City/State: Chicago, IL

3. Project Description: Retro-Commissioning

Project Study/Design Period: June 2011 (Begin date (mm/yyyy)) to May 2012 (End date (mm/yyyy))

Percent Occupancy at time of submission: 100%

4. Entrant (ASHRAE member with significant role in project):

a. Name: Villani (Last) John (First) D (Middle)

Membership Number: 5157583

Chapter: Illinois

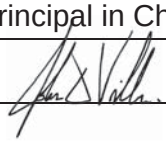
Region: IV

b. Address (including country): Grumman/Butkus Associates 820 Davis St., Suite 300

Evanston (City) IL (State) 60201 (Zip) United States (Country)

c. Telephone: (O) 847-316-9271 d. Email: jvillani@grummanbutkus.com

e. Member's Role in Project: Principal in Charge

f. Member's Signature: 

5. Engineer of Record: NA

By affixing my signature above, I certify that the information contained in this application is accurate to the best of my knowledge. In addition, I certify that I have discussed this entry with the owner and have received permission from the owner to submit this project to the ASHRAE Technology Awards Competition.

2013 AWARD ENTRY

Illinois Chapter of ASHRAE Excellence in Engineering

University of Chicago Medical Center
Duchossois Center for Advanced Medicine

Retro-Commissioning

Grumman/Butkus Associates
Energy Efficiency Consultants and Sustainable Design Engineers
820 Davis Street, Suite 300
Evanston, IL 60201.4446
847 328.3555 FAX 328.4550

Illinois Professional Registration #184-000926

University of Chicago Medical Center – Duchossois Center for Advanced Medicine

This Duchossois Center for Advanced Medicine (DCAM) was retro-commissioned in 2011-2012 as a part of the ComEd Smart Ideas Incentive Program. The 538,000 square foot building was constructed in 1995 and is comprised of outpatient exam rooms, procedure rooms and operating rooms. Typical operating hours for the building are 7:00 am – 7:00 pm Monday through Friday and 7:00 am – 6:00 pm on Saturday.

The intent of the retro-commissioning project was to identify and implement low cost, short payback energy reduction measures to improve the energy efficiency of the building and reduce annual operation costs.

At the end of the project, the verified energy savings from the project resulted in a 26% reduction in electric energy usage and 23% reduction in natural gas usage. The project had a simple payback of 0.1 years and the estimated total annual cost savings exceed $560,000. The Dushossois Center for Advanced Medicine project is a great example a successful retro-commissioning project.

HVAC System Description

There are eight (8) variable volume air handling units and one (1) constant volume air handling unit located in the penthouse of the building. The units have steam pre-heat coils and chilled water coils. The terminal units throughout the building (excluding the third floor) are pneumatically controlled and actuated with hot water reheat coils. The terminal units on the third floor of the building were built out with electronic control after the initial construction.

The chilled water for the building is supplied by a central plant located in an adjacent building. Primary pumps in the plant deliver chilled water to the building. The chilled water is then pumped by secondary chilled water pumps to the AHU chilled water coils in the penthouse. Air cooled chillers on the roof provide chilled water for the operating room AHU and process chilled water for equipment. The heating load for DCAM is satisfied by central steam plants. Two heat exchangers in the DCAM basement convert high pressure steam to hot water for baseboard radiant heating and the VAV box reheat coils.

The Retro-Commissioning Project

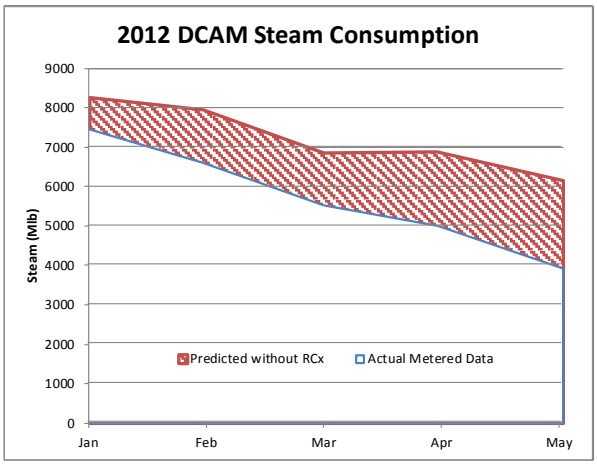
The University of Chicago Medical Center (UCMC) staff was fully invested in achieving energy savings in DCAM. Grumman/Butkus Associates worked side by side with the UCMC project manager throughout the project. Having the client buy-in was essential to the success of this project.

During the planning and investigation phases of this project, nine retro-commissioning measures (RCMs) were presented to UCMC. Six of these measures were implemented and verified. The majority of the energy savings resulted from two of these measures.

A significant portion of the electrical energy savings was a result of scheduling air handling units. The RCM reduced the airflow throughout the building during unoccupied hours. The amount of reduction was increased incrementally over a period of three months. Throughout this process GBA reviewed temperature data from data loggers to confirm the space temperature was acceptable during occupied and unoccupied hours.

A majority of the natural gas savings came from correcting a combination of issues with the steam to hot water heat exchangers. This hot water system optimization measure repaired the steam control valves, replaced the hot water differential pressure sensor and implemented hot water temperature reset. During investigation we found the pneumatic steam control valves failed full open and the hot water pump differential pressure sensor failed. This caused the heat exchangers to constantly operate at full steam flow and elevated hot water flow.

Since the energy savings for this project were so significant GBA went above and beyond the ComEd RCx verification requirements. The basic verification requirements would be to confirm that the heat exchanger controlled correctly for two weeks after implementation. After we satisfied that requirement, we collected several months of utility data showing reduced steam consumption. The graph to the right shows the difference in predicted steam consumption and actual steam consumption.

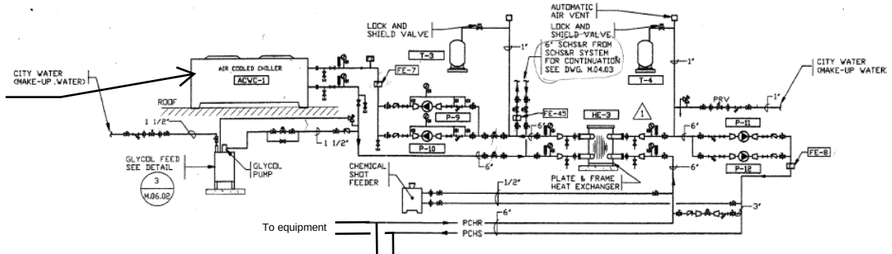


We were convinced the hot water system was corrected and that steam consumption decreased but we went a step further. With such a high amount of steam savings we wanted to know where the energy was being lost. Review of the AHU return air temperatures showed that the average return air temperature decreased for all of the air handling units after implementation. We suspect that many of the reheat coils were providing too much flow because the pumps were providing excess pressure.

The savings calculations were developed by Grumman/Butkus Associates and reviewed by the ComEd RCx program administrator, Nexant, and then reviewed by a third party, Navigant. The project's verification results are presented in the table below. The final totals estimate a simple payback of less than two months.

RCM No.	Measure Description	Peak Demand Savings (kW/mo)	Electrical Energy Savings (kWh/yr)	Electrical Cost Savings ($/yr)	Natural Gas Energy Savings (therms/yr)	Steam Cost Savings ($/yr)	Impleme-ntation Cost ($)	Simple Payback (years)
1	Economizer Optimization	0.0	199,905	$15,423	0	$0	$946	0.06
2	Supply Air Temperature Reset	0.0	277,028	$19,392	51,427	$63,573	$4,491	0.05
3	Night Time Zone Airflow Setback	0.0	2,217,730	$155,241	12,035	$14,878	$36,085	0.21
4	Equipment Operation Scheduling	0.0	144,971	$10,148	5,982	$7,395	$8,102	0.46
5	Discharge Static Pressure Setback	This measure was not implemented						
6	AHU-3 Supply Fan Speed Control	This measure was not implemented						
7	Simultaneous Heating and Cooling	0.0	10,367	$804	2,614	$3,231	$0	0.00
8	Lower Compressed Air Setpoint	This measure was not implemented						
9	HW and CHW Pump Optimization	0.0	47,503	$3,629	218,767	$270,436	$3,502	0.01
Electric & Gas Total		0.0	2,897,504	$204,638	290,825	$359,512	$53,726	0.10
Electric Only Total		0.0	2,897,504	$204,638	--	--	$53,726	0.26

Process chilled water for equipment (linear accelerators, CT scanners, etc) and AHU-3



Chilled water to all AHUs

Chilled water from central plant

Hot water for terminal units

High Pressure steam for AHU heating coils.

AHU-1 | AHU-2 | AHU-3 | AHU-4 | AHU-5 | AHU-6 | AHU-7 | AHU-8 | EF | AHU-9

Penthouse

6th Floor

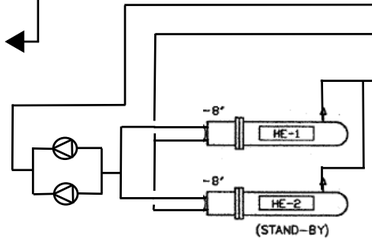
5th Floor

4th Floor

3rd Floor

2nd Floor

1st Floor



Ground

University of Chicago Medical Center - DCAM: HVAC Systems Diagram