The facility personnel implemented these recommendations and are now saving 37.4% of their baseline energy usage every year

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Aurora Corporate Building – Site Visit Notes
February 25, 2009
Brian Basken

1. This building serves as an office building with normal business hours. It houses approximately 60 people.
2. The energy usage for this building in 2008 was 190 Kbtu/sq ft. The average building according to the Energy Information Administration 2003 Commercial Buildings Energy Consumption Survey is 93 Kbtu/sq ft. There is a lot of room for improvement.
3. HVAC system consists of 4 fan systems with individual DX cooling.
4. Systems are constant volume with HW reheat coils. Reheat coils are locally controlled by room thermostats. The basement has electric reheat coils. This type of HVAC system is the most wasteful, especially in an office environment where the building is rarely at design condition and fully occupied.
5. Perimeter heat elements have local self-contained thermostatically controlled valves.
6. Boilers were replaced 2 ½ years ago. There are two 500,000 btu boilers, with good efficiency, and are fully modulating down to about 33% of their capacity.
7. The expansion tank is incorrectly piped so the system gets bound with air. This causes them to operate the system at a higher temperature than is really necessary. The expansion tank problem is scheduled to get fixed this spring.
8. Boilers are controlled by a stand-alone Tecmar controller with a simple outdoor air reset.
9. Ed is trying to budget for the replacement of the two large rooftop units. We recommend reviewing the economics of converting the system to VAV at this time. If it isn't cost effective to convert to VAV, then we recommend upgrading the reheat coil valves and controls to DDC. If the position of these valves are know by the Building Automation System, then the HW temperature can be intelligently reset, and the discharge temperatures and pressures on fan systems can also be intelligently reset.
10. If an entire VAV system is not cost effective, then we recommend getting VAV rooftop units so the speed of the fans can be varied depending on the load. For example, the fan speed can be reduced for a few hours in the morning and at the end of the day. It will only need to speed up when the spaces require more cooling. We also recommend adding zone dampers to stop airflow and the wasted reheat energy in the many conference rooms that are not continuously used. An occupancy sensor could be used so that when a person walks into the conference room, the damper opens and the system operates as it normally would. In this scheme, the damper should not go completely shut when the space is unoccupied. We recommend only allowing the damper to close to about 10% open.

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11. We recommend adding CO2 sensors to the return air to each system and doing demand controlled ventilation. The current system is bringing in large quantities of outside air for the worst case scenario of maximum people. There are very few times in a year when this actually occurs.
12. We also recommend replacing the Tecmar controller with DDC controls. There is plenty of opportunity to reduce the hot water temperature if feedback from the system can be used. Also, from an alarm and maintenance point of view, it would be useful to know when a boiler has failed.
13. The fan systems generally operate from 5:00am until 9:00pm. The fans used to shut down at 6:00pm, but Ed had to change the schedule because of the cleaning crew. This extra wasted energy is clear when comparing the electrical energy versus the model from the previous year. The current electrical energy usage is 15% higher than the model. We recommend going back to shutting down the systems at 6:00pm.
14. The fan systems also operate on weekends. We recommend creating a way for users to override the fan system on for a few hours if they work late in an evening or come in on a weekend. An override can be a spring wound timer in an accessible location or can be high tech like a user logging into the graphic front end to the Building Automation System and only having access to override the HVAC system on for a limited amount of time. When this override is completed, then we recommend normally scheduling these fan systems to be off all weekend.
15. The natural gas consumption is about 10% lower than the model from the previous year. This is likely due to the staff making better use of the new boilers and adjusting the reset schedule.
16. Lighting was newer on the lower floor with indirect lighting. Occupancy sensors could be used to make sure all of the lights are turned off each night. A simpler solution is to make the cleaning crew responsible for turning the lights out when they leave.
17. Short term recommendations – The biggest savings I see is to reduce the hours of the fan system operations. Go back to turning fans off at 6:00pm. On weekends, most offices like this one will run the fans from 8:00am until 2:00pm on Saturday, and then off on Sunday. I recommend trying this. Because the people in this building are the upper management of your organization, try to communicate with them about these changes first. They will understand that you are trying to save energy and utility costs, and may be more willing to allow these changes than other office workers. You may also learn that none of them come in on weekends. With laptops and the internet, more and more people can work from home instead of staying late at night or coming into the office on weekends.
18. Short term recommendations – Be more aggressive on the existing hot water reset schedule. Lower the range by 5 or 10 degrees at a time, let it operate for a week, and then keep lowering if there aren't any complaints. You may want to wait on this until the piping gets fixed and the air problems go away. Unfortunately, these boilers are not condensing boilers, so you don't want to go lower than their recommended entering temperatures.

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19. Long term recommendations – Replace the existing systems with VAV air systems and DDC controls throughout the building. This could reduce the energy usage in this building by 25%-50%. We can do some detailed calculations to predict the energy reduction when you are ready to upgrade the systems.
20. Other recommendations
    a. Use higher efficiency condensing hot water boilers when replacing old boilers. The boilers in this building are better than conventional boilers, but you can still get more efficient boilers. Condensing boilers allow the hot water temperatures entering them to be much lower without having to add a three way control valve and extra pumps. Their costs have come down over the past few years because more manufacturers are making them.
    b. A low cost alternative to upgrading small fan systems to DDC is to install a relatively new programmable thermostat from Honeywell. They have a light commercial touch screen programmable thermostat that can have 16 of them connected to a $1000 piece of hardware and you can have remote web access to all of the setpoints in the thermostat, including the current status of the system and some trending ability. These intelligent thermostats are only a little more money than a normal programmable thermostat. I can send you more information if you are interested. I've seen a demo, and I think most HVAC techs who can replace a thermostat can install this system.