Energy Man
Conserving energy saves money
Lonnie Russell, CEM
(843) 469-5111
lrussell@energymanllc.com
Fax: (480) 393-5994
www.EnergyManllc.com
Energy Audits in Action by EnergyMan LLC
The goal is to try to make the biggest impact possible with little or no investment. Start with the largest electrical loads and gas users.
Important Question: Why is this operating with no one here?

*Must do some of audit during non-occupied times*

*These items were found on 24/7 during non-occupied times.*

Programmable thermostat in override and set to 68°F in the summer

Boiler

10 Air handlers with a combined horsepower of 68.5
This is equipment in the cabana; only used seasonally, but it was all on; 3 refrigerators were empty and on, stove had it’s pilot light on and hot water heater was not turned off.
The auditorium is a very large space to leave the HVAC system running when the room is not in use.
Computer monitors left on
The current IT PC policy is not helping with PC power consumption, as can be observed by the hundreds of PC's that are left on 24/7.

At an absolute minimum, the monitors should be set to go to standby. Leaving these all on puts a heavy load on the HVAC system, which may not have been originally designed for this large a load.
### Annual Electrical Operating Costs for electric motors

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<th>Motor Size</th>
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- Initial motor cost is only about 5% of the total lifecycle cost, so always buy an efficient motor!
Why does equipment not get turned off?:

- Lack of control of building during off hours, especially in buildings with multiple users.
- System was set up that way from the beginning and no one on site knows how to correct it.
- It has always been that way so no one notices.
- We tried that once but....
- You can’t turn that off. It may not turn back on (my personal favorite).

This is not limited to smaller facilities. Here are some sizable loads at a large facility.

Chiller and associated equipment

Chiller Primary and Secondary pumps

Cooling Tower Pumps

Cooling Towers
Now that the schedule is optimized how do we make our HVAC system more efficient?

- Tighten up the building and ductwork
- Control the outside air (preferably with demand controlled ventilation) and Economize, if possible
- Install VFD’s where possible
- Lighting
- Energy efficiency products
- Minimize, or eliminate reheat
- Optimize the set points (room temp, chill water, hot water, non-occupied, occupied etc…)

  - **ASHRAE states that 80% of all occupants will be comfortable at temperatures of 68F to 74F in the winter and 73F-78F in the summer at no > 60% RH.**
SCGSAH 1st year Results (operational changes only!)

**Natural Gas Usage**

- 2008
- 2009

Reduction of **51.7%**

**Electricity Usage**

- 2008
- 2009

Reduction of **28.6%**

**YTD Natural Gas Cost**

- 2008
- 2009

Reduction of **60.4%**

**YTD Electricity Cost**

- 2008
- 2009

Reduction of **18.4%**
Building Envelope Improvement

This building had many major air leaks that needed to be addressed. Major leaks included:

- Exhaust fans with no dampers so they would be wide open when not running
- Overhead doors with no seals
- Bathroom exhaust fans that never shut off
- Large gaps around fan shrouds
- Large louvers that were open to the outside

Open Exhaust Duct  |  Backdraft Damper Installations
Air infiltration repair (Overhead doors)

Before

Before (sunlight leaking in)

Curtain for frequently used door

Brush seal

After
Building Envelope and Leaky ductwork examples

- Faulty Duct Insulation
- Missing Insulation
- Open Roof Access
- OA damper stuck open
- Ductwork insulation in bad shape
- No floor insulation in crawl space
Negative Pressure from Bathroom Exhaust Fans

Bathroom Exhaust fans were on 24/7. When HVAC equipment was shut down, these fans exhausted 2000 cfm and pulled air in from outside causing humidity to rise at night.

Fan switches were hidden and always left on.

Sensors were installed to automate the bathroom exhaust fans so they would run for 15 minutes when the bathroom became unoccupied and then shut off.
Outside air control opportunities

Some places, such as churches and auditoriums, have high outside air requirements because of the per person ASRAE ventilation requirements. This is partly to prevent the “sick building syndrome” issues that occurred when buildings did not ventilate adequately in the past.

Sanctuary Outside Air Intake

Using CO2 monitoring, and controlling the outside air intake based on that, allows for proper outside air intake. Otherwise, you could be bringing in the outside air requirement for hundreds of people no matter how small the occupancy is. This technique is called “demand controlled ventilation”. The price to do this type of control has dropped substantially in the last few years, with CO2 sensors now barely over $100.00 and damper controllers for about the same.
AHUs were initially set at 10% - 15% OA damper open at all times. Especially in the hot humid summers of South Carolina, this can unnecessarily load the system. CO2 sensors were installed and set to fully open the OA dampers if CO2 levels rise to levels > 1000 ppm.
Make outside air your friend! Economize (frequently called free cooling) for your winter heat loads. Able to shut down all but the air moving parts of the HVAC systems (chillers, pumps, compressors etc...).

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Economizer possible for 2309 to 3961 hours. High bays maybe an additional 1000 hours.
Outside air damper can only be open or closed: cannot be modulated.

Installed Modulator

Return air had no damper, therefore ratio of return versus outside air cannot be controlled.

Installed Modulating Damper
Advantages of a Variable Frequency Drives (VFD’s)

HVAC systems are generally built for the 10 hottest and 10 coolest days of the year. There is generally overcapacity for all other conditions. VFD’s offer the ability to match the system to the load, offering tremendous energy savings and extending equipment life.

A 50% reduction in flow actually reduces horsepower requirements by 87.5%
Pumping power is wasted (valves are partially closed) making the pumps good VFD (variable frequency drive) candidates. The pumps (2) also run continuously.