THE ENERGY OBSERVER

Energy Efficiency Information for the Facility Manager

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Improving Indoor Air Quality With Demand Control Ventilation

The Energy Observer summarizes published material about proven energy related technologies and practices, and encourages the sharing of experiences with generic products and services. This quarterly bulletin also identifies informational sources and energy training for facility managers and staff. ***The Energy Observer*** is published by the **Energy Office, Michigan Department of Labor & Economic Growth.**

A combination of proper HVAC system balancing, careful calculations and equipment upgrades can reduce outside air intake while still providing safe clean air to the occupants of the building. These measures will reduce the amount of energy required to condition air flowing through the building.

Ventilation Requirements

The American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) has developed solutions to improve poor indoor air quality. One solution is to increase the volume of outside air from 5 cfm to 20 cfm for offices and 15 cfm for classrooms. Another solution is identified as Demand Control Ventilation (DCV). DCV is a method of adjusting the volume of outside air based on need. This includes, but is not limited to, adjusting the air volume to match the building's actual occupancy, cleaning and filtering re-circulated air, carbon dioxide sensing, volatile organic compound (VOC) sensing, and heat recovery.

One of the most common methods of DCV is carbon dioxide monitoring. ASHRAE Standard 62-1989 specifies 1000 ppm of carbon dioxide as the action level at which added ventilation air is required. 850 ppm of carbon dioxide is a good operating level.

With DCV technologies HVAC Systems can be designed to meet exact occupancy requirements while saving up to 20% of operating costs.

Filtration Systems

Air contaminates in buildings are generally a mixture of human effluents as well as emissions from building materials. As more contaminates are filtered out of a system, a higher percentage of return air can be re-circulated through the building. This percentage is based on the filter efficiency, types of known contaminates, and type of filter media. Consult your local HVAC experts for advice on improving your filtration system.

Regular Maintenance of HVAC Systems

Regular maintenance should be conducted on HVAC systems to ensure that the system is running at its optimal efficiency. Regular cleaning of the ductwork, filters and other components will increase the quality of the air and prolong the life of the equipment. Each facility should have a plan for regular maintenance work. Consult your local HVAC experts for advice on improving your maintenance schedule.

Energy Recovery

The air in buildings may not always be fit for re-circulation so there are ways to remove or recover energy from air leaving the building and transfer this energy to the incoming air. By tempering the incoming air, less energy is required to heat/cool the air before it is circulated through the building, therefore, not all of the energy in the exhaust air is wasted. Some energy recovery options are heat wheel systems, heat pipes and runaround loops.

A heat wheel operates by transferring thermal energy from the exhaust air to the incoming air.

This energy is transferred through a conductive mesh material. The two air streams must be adjacent for this method.

Heat transfer pipes also recover energy from the air used in a building. The pipe is filled with a heat transfer fluid that evaporates and condenses from one adjacent air stream to the other. The heat at one end of the pipe evaporates the fluid and the cold at the other end condenses the fluid. As this process occurs, the fluid is forced from one end of the pipe to the other.

Runaround loops are ideal for situations in which the intake and the exhaust are separated. Runaround loops use water or glycol systems to transfer energy from one point to another. In some cases, this takes additional pumping energy and extensive piping.

Demand Control Ventilation

Demand Control Ventilation (DCV) is best used in large areas that are not occupied on a full-time basis such as auditoriums, classrooms, bathrooms, gymnasiums and offices. All of these areas are designed for high capacities, but they seldom reach their design capacity. This condition leads to over ventilation and wasted energy.

One type of DCV uses carbon dioxide detectors to control dampers or fan speed to vary the ventilation rate. People produce carbon dioxide when they breathe, so, as the number of people in an area increases, the carbon dioxide level will increase as well. Ventilation is based on occupancy; therefore, increases in carbon dioxide levels signal the need for more outside air ventilation. Energy savings of 20% to as high as 80% have been documented using carbon dioxide sensing.

Carbon dioxide sensing is popular because virtually all major building control and HVAC equipment manufacturers offer carbon dioxide sensors to complement their products. Often times these sensors are "plug and play" which means very little modification to the system and very little down time are required.

Carbon dioxide sensors are popular because they are easily adapted to different systems without major expense or modification to the existing system.

Volatile Organic Compound (VOC) monitoring, another type of DCV, should also be conducted in locations near major highways, truck loading docks and shipping areas. VOCs are often the result of vehicle exhaust and building material emissions. While there are not universally accepted VOC sensors at this time, there are ways to test for VOCs and adjust the airflow based on those results. Consult your local HVAC experts for assistance in testing the contaminate levels in your facility.

Testing for high carbon dioxide and VOC levels will not always guarantee good indoor air quality because there is a wide variety of possible contaminates. However, with proper maintenance, controls and monitoring of carbon dioxide and VOC levels, good indoor air quality is generally the result.

Direct Digital Control Systems

Further monitoring of the HVAC system can be done by upgrading to a Direct Digital Control (DDC) system. A DDC system allows the facility to monitor inlet and outlet air temperatures, pressures, carbon dioxide levels and individual zone climates. Building work schedules can be programmed into the system to reduce the amount of ventilation in the building when it is not in use. After all of the operating parameters have been set up the DDC system controls the flow of air through the building using the most efficient method allowed within those parameters. The system can then be monitored at a central location providing a good starting point for troubleshooting air handling problems and concerns. Look for more information about DDC systems in future issues of ***The Energy Observer***.

For more information on indoor air quality for large buildings visit:
www.epa.gov/iaq/largebldgs

Visit the State of Michigan Energy Office website for information on current programs, training, and grant information.
www.michigan.gov/energyoffice

If you have experience or data that you would like to share on this topic or if there is a topic that you would like to see discussed in a future issue of ***The Energy Observer*** please contact Brandy Minikey (contact information below)

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