Exhaust Fan Savings

ENERGY SAVING – FACT SHEET

Energy Conservation Opportunities

Some exhaust fans operate continuously and many operate when not necessary. When building codes and standards permit, it is important to turn exhaust fans off when they are not serving a useful purpose. There may be opportunities to more efficiently control exhaust fans in areas such as restrooms, locker rooms, showers, gymnasiums, laboratories, custodial closets, dedicated copy rooms, laundry rooms, food preparation spaces, and other locations. Better control of exhaust fans not only saves the electricity required to operate the fan but also the cost of conditioned air that is exhausted unnecessarily.

Choosing the Best Solution

In the case of restrooms, exhaust fans can be rewired so that fans operate only when restroom lights are switched "on." Even if fans are best left on when a building is occupied, at least savings are realized during unoccupied hours. Another option is to install occupancy sensors to control both the exhaust fan and lighting circuits. A wide variety of manual, electronic and programmable timers are also available for use where fan operations are related to the scheduled use of a space. In facilities where building automation systems (BAS) are utilized, exhaust fans can be controlled directly through the BAS and set for scheduled occupancy use.

In the case of gymnasiums, it is often preferable to control exhaust fans with a thermostat when exhausted and makeup air are used primarily to maintain the most comfortable conditions possible during the summer months.

Behavior awareness is always a good starting place to encourage building occupants to keep exhaust fan and lighting circuits off when not in use.

Predicting Potential Cost Savings

Turning off exhaust fans when they are not needed will save the cost of electricity needed to power the fan and reduce HVAC cost for conditioned make-up air. The electrical use required for a range of exhaust ventilation fans is shown on the following page based on fan CFM ratings.

Successes in Exhaust Fan Control at the Western Justice Academy

The Western Justice Academy, in Edneyville, NC, is a five-building complex with over 80,000 square feet (sf) of conditioned space. The Physical Plant staff has implemented measures to greatly improve controls of exhaust fans in the following areas:

1) Three large one-horsepower [6000 cubic feet per minute (CFM)] fans were used to ventilate the 10,800 sf gymnasium. Because the gymnasium is now heated and cooled, use of the exhaust fans has been discontinued. Previously the fans were manually controlled with timers by the users of the gym. The manual controls of these fans saved about $3.10 per hour when not in use.

2) Controls for all restroom exhaust fans are linked to a central Building Automation System (BAS), a Johnson Controls Metasys system. Each week, training and occupancy use schedules are programmed into the BAS. The restroom exhaust fans are tied to air handler circuits that are controlled by the BAS. While in an 'unoccupied' mode, exhaust fans, as well as many other building functions, are turned off. The bathroom exhaust fans account for approximately 5650 CFM across the campus. The estimated cost saving for this control technique is $1.15 for each hour not operated or $4,025/year.

Staff education and instructional signage are an important component of the gymnasium controls. For more information, contact Doran Harris, Physical Plant Supervisor, NC Justice Academy, (828) 685-1183 ext 246, e-mail doharris@ncdoj.com

To identify the CFM rating of an existing fan, review nameplate data on the fan system or on the motors. CFM estimates also can be made by considering typical 'design' standards. For example, office restrooms typically require 75 CFM per toilet or urinal. Use the application charts above to determine your own potential savings.

Other Fan Efficiency Options

There are numerous other ventilation fan upgrade opportunities to improve efficiency. See the "References" section for a starting point.

Calculate Your Potential Savings

Cost Saving/year ($/yr) = Fan Energy Savings (FES) + Conditioned Air Savings (CAS)

FES ($/yr) = _____ Hours/yr fan use reduction x _____ ¢/hr/100 cost to operate fan*

CAS ($/yr) = _____ Hours/yr fan use reduction x _____ ¢/hr/100 cost to condition air**

Example:

Controlling a 150-CFM Exhaust Fan in a Two-stall Restroom with an Occupancy Sensor (Raleigh):

FES = 1200 hour/yr*** use reduction x 1.3 cent/hr* / 100 = $15.60/yr
CAS = 1200 hrs/yr x 2.9 cents/hr** /100 = $34.80/yr
Cost Saving/year = $15.60 + $34.80 = $50.40/yr

* Use value from Fan Energy Use Chart,
** Use value for Cost of Conditioned Exhaust Air Chart
*** Assumes 40% reduction in use for a 3000 hour work year in an office setting

Cost of Conditioned Exhaust Air - Cents per Hour of Fan Use (¢/hr)

FAN SIZE	Asheville	Charlotte	Greensboro-Winston-Salem	Raleigh	Wilmington
75 CFM	1.6	1.5	1.6	1.5	1.2
150 CFM	3.2	2.9	3.2	2.9	2.4
300 CFM	6.5	5.8	6.2	5.8	4.9
500 CFM	10.7	9.7	10.5	9.7	8.1
1000 CFM	21.6	19.3	20.8	19.3	16.3
5000 CFM	107.9	96.7	104.0	97.0	81.5

Assumes 85% efficiency natural gas heating and cooling with 10 SEER air conditioning. Natural Gas cost assumed at $1.32/therm and average commercial electricity at $0.086 per kWh.

Exhaust Fan Energy Use

Axial Exhaust Fans Rated CFM	Typical Efficiency (CFM/watt)	Cost per hour (¢/hr)
75	0.9 - 3	0.2 - 0.7
150	1 - 3.5	0.4 - 1.3
300	1.5 - 3.5	0.7 - 1.7
500	2.5 - 4	1.1 –1.7
1000	3 - 5	1.7 - 2.9
5000	4 - 20	2.2 - 10.8

Efficiency of exhaust fans varies greatly with age and design. Older fans are assumed to be the least efficient. Average commercial electricity at $0.086 per kWh.

References & Resources:

- Energy Management Handbook, Third Edition, Wayne Turner, 1997.
- Handbook of Energy Engineering, Fourth Edition, Albert Thumann, 1977.
- EPA Energy Star Products, www.energystar.gov/index.cfm?c=vent_fans.pr_vent_fans
- Grainer Industrial Supply Catalog, 400. www.grainger.com

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