save Energy save Dollars

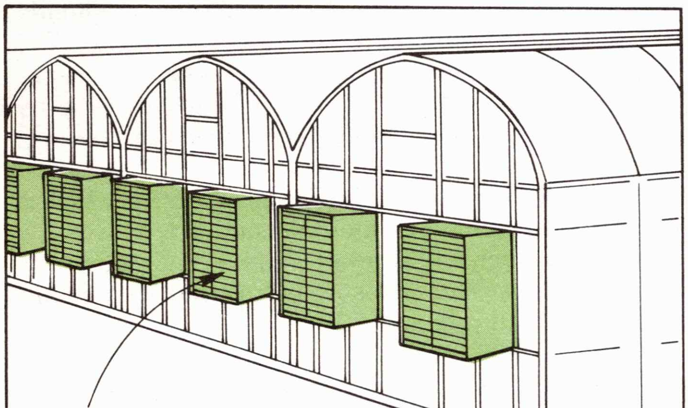
Cooperative Extension, New York State

Choosing and Maintaining Ventilation Fans

Since many greenhouses, poultry and livestock operations have a large number of fans that run much of the time, ventilation is often the greatest single consumer of electricity. If you are buying new fans, buy the most energy efficient ones you can find. Unless the fans will be used only a small fraction of the time, they will pay for themselves in electricity savings within a few years.

Fan Efficiency

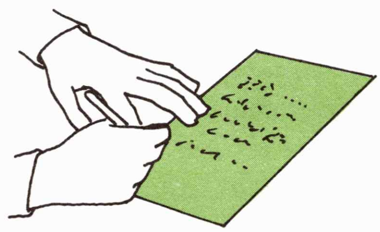
Fan efficiency, or the "cfm per watt ratio", is a measure of the number of cubic feet of air moved per minute (cfm) per watt input. The "cfm per watt ratio" is also called the Ventilating Efficiency Ratio (VER). This term was chosen to parallel the Energy Efficiency Ratio (EER), which is a rating system for air conditioners. VER ratings for fans range from about 10 to 20, with most around 12 to 13.



Energy-efficient fans will pay for themselves in electricity savings within a few years

Fans vary in ventilation efficiency from 10 to 20 cubic feet of air moved per minute per watt of electrical input.

How Much Do I Save?



Consider the following example:

Assume two 36-inch fans with 1/2 horsepower motors, both rated at 9500 cfm. One fan has a VER of 20, the other a VER of 10, with the more efficient fan priced $150 higher. If the fan will be used 40 per cent of the time during a given year, and the cost of electricity is 5 cents per kilowatt hour (kwh), which is the better buy?

Calculations for the more efficient fan yield a total energy use for the year of 1700 kwh. At 5 cents per kilowatt hour, the cost in electricity is $85 a year. The electricity cost for the other fan, which is only half as efficient, is $170. The more efficient fan saves $85 in electric bills each year, a 57 per cent return on the extra investment of $150. If the fan lasts for ten years, the savings is $850, without accounting for any electric rate increase.

Often more efficient fans are of higher quality construction and thus may last longer than less efficient ones; so the savings may be greater than computed here.

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Another way to translate the data into dollars, is to assume a maximum ventilation rate of 100,000 cfm is needed for a 3 bay, 63′ x 200′ greenhouse. The fans are assumed to operate an average of 35% of the time over the year.[a] The expected yearly operating costs of four typical fans are listed in Table 1. For example it may cost $1226 minus $803 or $423 more per year to ventilate the area with fan C than fan D if electricity costs 5¢ per kwh.

Table 1. Yearly operating costs to supply 100,000 cfm for 35% of the year.

Model	Efficiency cfm/watt 36" dia. fan	Yearly Energy used, kwh	Yearly operating cost at a kilowatt-hour electricity cost of 4¢	5¢	6¢	8¢
A	14.6	21,000	840	1050	1260	1680
B	14.0	21,900	876	1095	1314	1752
C	12.9	24,500	981	1226	1472	1962
D	19.1	16,100	642	803	963	1284

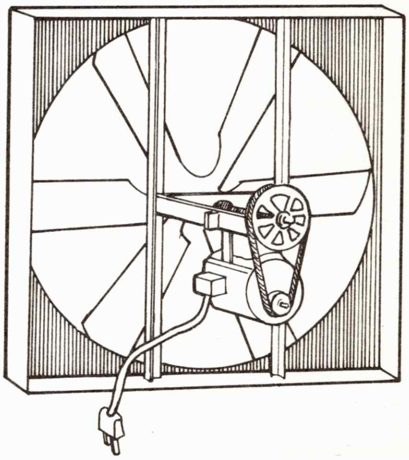
High efficiency fans will ventilate a 12,000 square foot greenhouse for $400 to $800 less annual electrical cost than low efficiency fans.

Finding the Efficient Fan

At present, fan efficiency ratings are not readily available. A few manufacturers have published energy efficiency data for their fans, but many others have not made these figures available. You should contact the manufacturers and ask for these published ratings. In addition to helping you choose the most energy-efficient fans, this action may prompt the industry to adopt energy-use standards and make the efficiency ratings more widely available.

If you cannot obtain energy use ratings, the following pointers can help you choose the most energy efficient fan:

- In general, a larger fan is more efficient than a smaller one. The larger blades will move more air per unit of input power.
- For any given area, a few larger fans are usually more efficient than many small ones.
- For any two fans with the same diameter, the one with the smaller motor is usually the more energy efficient.
- Two value (dual) capacitor motors are the most efficient—as well as the most expensive. They are usually not available below 1/2 horsepower. Other types of motors—universal, permanent split capacitor, capacitor start/induction run and split phase—are less efficient.



Ask for energy efficiency data when selecting a fan.

Static Pressure

Airflow resistance is created by restrictions such as inlet vents, cooling pads, exhaust outlets, fan shields and louvres, and prevailing breezes. To overcome the resistance, the fan builds up a difference in pressure between the inside and outside of the house. This pressure difference is called **static pressure.**

Since the static pressure in greenhouses is very low, it is measure in inches of water pressure. For example, a pressure of 1 inch will support a 1-inch-high column of water in a tube. This pressure is less than 0.04 pound per square inch (psi).

Usually an exhaust fan operates against a static pressure of no more than 0.1 inch, while a fan attached to a tube or duct operates against 0.2 to 0.5-inch static pressure. It is important to know air delivery at these static pressures, since a fan delivers less air when it works against pressure.

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[a] Poultry house fans typically operate an average of 60% of the year, so fan operating costs are 60/35 = 1.7 times those shown in Table 1.

Normally the fan capacity at 0.1-inch static pressure is about 80 percent of the free air capacity, or when no resistance is offered to the fan. So if a fan's free air delivery rating is 10,000 cfm, it will only deliver about 8,000 cfm when louvres are placed on it and it is installed in a greenhouse. This assumes the belt is properly tightened and the fan is turning at the recommended rpm's.

It is important to know a fan's air delivery rate at design pressure.

Certified Ratings

Since a fan's sole purpose is to move air, it is highly important to know how much air a selected fan will deliver. Many manufacturers have their fans checked by a standard test procedure certified by the Air Moving and Conditioning Association (AMCA). Performance charts of fans with this certified AMCA rating are a reliable indication of the fan's air-delivering capability.

Maintenance

Keeping a fan in good repair is as important in reducing energy costs as buying the most efficient model. Poor maintenance can reduce a fan's efficiency by 50 percent or more.

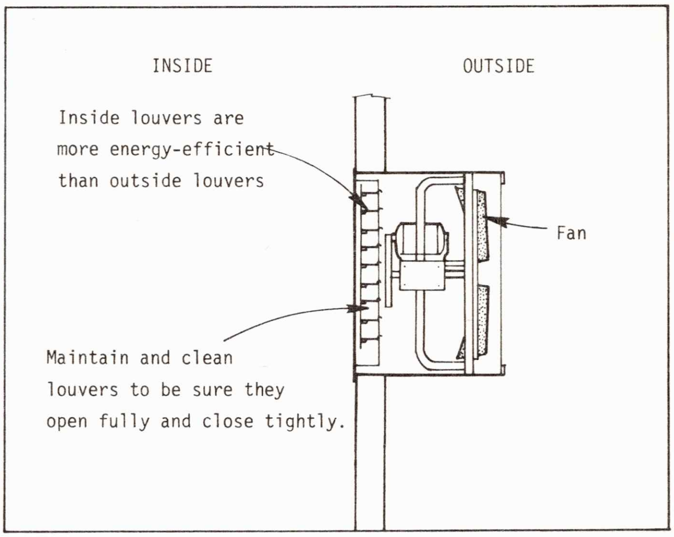
Belt adjustment is the single biggest maintenance problem with certain types of fans. Belt-driven fans must be regularly adjusted through the hot season for full air movement, so they should be easy to adjust. When a new fan or a new belt has been installed, the belt should be readjusted after 2 weeks of operation to take up the initial stretch.

Louvers

Louvers should shut tightly when a fan is not operating. If they don't, heat will escape and the boiler will have to stay on longer to make up for the loss. A single louver panel that will not close can waste up to $200 a year in fuel costs.

When the fan is on, louvers must be fully open. Otherwise they will restrict the flow of air from the greenhouse. A restricted fan operates longer and bears a heavier load to achieve the desired amount of cooling, which costs more in electricity. In many cases, you can repair louvers that are sticking open or shut just by cleaning them and applying oil and a rust solvent to the hinges.

Any obstruction on the discharge of a fan impedes air flow; that is fans with louvers on the outside are less efficient than comparable fans with louvers on the inside. You may have to spend some time shopping to find fans with inside louvers since most fan louvers are built to be installed on the discharge side.



Louvers are of two general types — motor-activated and air-activated. Air-activated louvers reduce air flow 20% to 30% and are less efficient because fan power pushes the shutters open. Motor-activated louvers eliminate that problem because the shutters lift and close automatically. In addition, motor-activated louvers will work even when dirty or when the joints get stiff, so they are less likely to let cold air in on windy winter days.

Safety Guards

Fans within reach of personnel should have safety guards to prevent accidents. The guard supplied by the manufacturer is usually best because it lowers fan efficiency very little. If you choose to fabricate a guard and it is installed within 4 inches of the moving parts use a woven wire mesh of at least #16-gage with 1/2-inch openings. If the guard can be farther than 4 inches from these parts, a 2-inch, #12-gage wire mesh screen has less air resistance and collects less dust. The guard should be hinged or easily removable for proper fan maintenance.

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