

Estimating the Efficiency of an Existing Ventilation Fan

(By Richard Hiatt, NFEC)

Situation: The first step in determining if a ventilation fan change-out is justified, is to estimate the efficiency of the fan currently in-use. Fan efficiency is measured in terms of its output CFM (cubic feet per minute of air delivery), divided by its energy input (watts).



Existing

Calculation: The following equation is used to estimate the yearly energy savings (kilowatt-hours) from a fan change-out:

$$\text{kWh saved per year} = \frac{\text{CFM}_{\text{old}}}{\text{CFM/watt}_{\text{old}}} \times \frac{\text{CFM}_{\text{new}}}{\text{CFM/watt}_{\text{new}}} \times \frac{1}{1,000 \text{ watts/kW}} \times \text{Hrs}$$



New

Where:

CFM_{old} = cubic feet per minute provided by the existing fan

CFM/watt_{old} = efficiency rating of the existing fan

CFM_{new} = cubic feet per minute provided by the new fan

CFM/watt_{new} = efficiency rating of the new fan

Hrs = hours of operation of the fan per year

Finding fan numbers: The only way to know both CFM and CFM/watt is to obtain the published **fan test results** for that particular fan model (see sources below). In the case of an existing fan manufactured prior to 1990, there are no usable test results available. In the paragraphs below, guidelines will be provided for making a reasonably-accurate guess for these fans installed before 1990.

I. In the case of fans installed *after* 1990, test results for most agricultural fans are available, but the user must know: (1) the diameter of the fan, (2) manufacturer and model number, and (3) static pressure within the building where the fan is used. Static pressure represents the “resistance” to airflow that the fan must operate against. Most fans used to exhaust air from a farm building will operate against a static pressure between .05 to 0.125 inches of water column. Fans which must pull air through a cooling pad or from a manure pit will operate under higher static pressures (near 0.50 inches of water). A more complete discussion of static pressure is beyond the scope of this fact sheet.

Sources for fan test results (fans made 1990 and after):

1. ***Agricultural Ventilation Fans: Performance and Efficiencies***, 2007 ed., Univ. of Illinois BESS Lab. Call 217/333-3572 for pricing. Also available from National Food and Energy Council, www.nfec.org.



2. ***Energy Efficient Ventilation Fan Ranking Guide*** (uses the identical source data from above, but rearranges it to rank fans by efficiency), 2006, EnSave, Call 802/434-3792 for pricing.



II. Older fans made in the 1980s or earlier can easily have efficiencies (CFM per watt) that are 75% of their modern-day counterparts. **Example:** A fan installed in 1983 with an efficiency of 12 CFM per watt could be replaced by a new one that delivers the same air volume at 16 CFM per watt (75% of 16 = 12). A change-out to the more efficient fan could rapidly pay for itself, depending upon the total run hours per year.

The only fan tests performed prior to 1990 were done by fan trade associations. These tests did not reflect on-farm installed conditions because the fan's shutters, guards and other components were not in-place during the tests. Therefore results from these sources can not be used to make accurate estimations of CFM output or fan efficiency.

Very old fans, or those that have been damaged, will have efficiencies that are even lower. One visual clue is the old-style "elephant ear" blade design on some of these fans. Other factors such as excessively dirty blades or shutters, belt slippage and other aerodynamic design factors all must be considered in the estimation. It is fair to say that replacing any of these very old or damaged fans with a modern fan can easily pay for itself in energy savings within three years or less, with normal hours of run-time.

As a general guideline for both old fans (Column A) and very old fans (Column B), consider the suggested values below. Notice that these values are only for .05 inches of static pressure resistance.

Efficiency Estimates for Ventilation Fans Made Prior to 1990		
Fan Diameter	(A) Efficiency Estimation (at .05" static pressure)	(B) Efficiency estimation for <i>very old</i>, "elephant ear" blades, or damaged fans (at .05" static pressure)
24-in.	13 CFM/watt	11 or less
30-in.	15 CFM/watt	13 or less
36-in.	16 CFM/watt	14 or less
48-in.	17 CFM/watt	15 or less
52-in.	Few made prior to 1991	

Rather than rely on estimated fan figures, it is best to obtain published fan test results whenever possible. Begin with the nameplate on the existing fan, and record the manufacturer's serial number, fan diameter and other identifying numbers. Because manufacturers offer several models of the same diameter fan, use only the test results for the particular fan in use. There can be significant variations in air delivery (CFM) and efficiency (CFM/watt) between two models that have been made by the same manufacturer and have identical fan diameters.

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