Annual Energy Savings Estimator for Variable Frequency Drives (VFDs) on HVAC Applications (Fans and Centrifugal Pumps)

Compares VFD capacity control versus other types capacity control.

To make Comparisons and Estimate Savings, need to know following:

a. Motor horsepower.
b. Cost of KwH of electricity.
c. Total hours of operation per year.
d. Present method of capacity control (guide vanes, fan curves, discharge vanes, control valves, etc.) that VFD will replace.

Step 1 : Converting motor Horsepower to Kw

_____ HP x .746 = 0 Kw_A

Step 2 : Multiply the Adjustable Frequency Drive Power Ratio (from table below) times Kw_A from Step 1.

_____ Ratio x 0 Kw_A = 0 Kw_B (using VFD)

0.28

Step 3 : Multiply the Power Ratio of the presently employed control (see below) times Kw_A from Step 1.

_____ Ratio x 0 Kw_A = 0 Kw_C (method now employed)

Step 4 : Subtract Step 2 Kw_B from Step 3 Kw_C.

0 Kw_C − 0 Kw_B = 0 Kw_D (savings using VFD)

Step 5 : Multiply Step 4 KW_D savings, times hours per year of operation, times cost of electricity per KwH.

0 Kw_D x _____ Hrs x $ _____ $/KwH = $ 0 VFD Annual Calculated Savings

Fans at 60% of maximum flow	
Ratio	**Flow Control Method**
0.28	Variable Frequency Drive
0.62	Inlet Guide Vane
0.88	Outlet Damper
0.88	Fan Curve
1.00	Bypass Damper

Pumps at 70% of maximum flow	
Ratio	**Flow Control Method**
0.40	Variable Frequency Drive
0.94	Discharge Valve
1.00	Bypass Valve
1.00	No control

Example: A 40 Hp VAV Discharge Fan motor, with an Outlet Damper, is running 14 hours per day, six days per week (4368 hours per year). Local electric charge is $0.127 per KwH.

Step 1: 40Hp x .746 = 29.84Kw_A

Step 2: .28 Ratio x 29.84Kw_A = 8.36Kw_B

Step 3: .88 Ratio x 29.84Kw_A = 26.26Kw_C

Step 4: 26.26Kw_C − 8.36Kw_B = 17.9Kw_D

Step 5: 17.9Kw_D x 4368Hrs x $0.127/KwH = $9929.7 in annual savings

The "maximum flow" of fans and pumps is based on the accepted assumption that they operate at 60% & 70% of maximum flow or capacity rates respectively, in HVAC applications.
The same accepted assumption is true of the "Ratios" of various flow control methods.
Substantiation data may be found in the ASHRAE Handbook, HVAC Applications Volume.

Savings are based on conservative assumptions and do not include any additional savings associated with improvin the Power Factor with VFDs (~.98), reducing Demand Charges, and increasing Electric Rates.