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Penelec
A FirstEnergy Company

Questline

CALCULATING ENERGY COST TO OPERATE A COMPR

Annual Electricity Cost:

[Horsepower x 0.746 x Hours x Electricity Cost] / Motor Efficiency

Where:
Horsepower (hp) = motor full load horsepower
1hp = 0.746kW
Hours = number of hours that the compressor operates
Electricity Cost = $/kWh (Add in demand charges and calculate average $/kWh)
Motor Efficiency = motor nameplate full load efficiency can vary from 75-95%

Example 1:
What is the annual electricity cost to operate a fully loaded 200hp compressor that runs 40% of the ti hrs/yr)? Motor efficiency is assumed to be 85%, so the compressor is drawing approximately 175kW. cost is $0.08/kWh. If the monthly demand charge is $10/kW - then the customer will be charged $1,7 month in addition to the kWh usage cost (51,040 kWh with the above assumptions). For this situatior overall average cost of electricity including the kWh use and demand charge is approximately $0.114

Annual Electricity Cost = [hp x 0.746 x Hrs x Electricity Cost] / Motor Efficiency

Annual Electricity Cost = [200hp x 0.746kW/hp x 3,500hrs x $0.114/kWh] / 0.85

Annual Electricity Cost = $70,036

If the motor in the above example were increased to **92%** efficiency, the annual electricity cost would reduced to **$64,707**.

Example 2:
Let's say that you want to make a more precise calculation for a three-phase compressor. Example 1 include system losses for belts, fans, pumps, etc. Therefore, it is more accurate to measure input kW voltage and current. Using the same scenario where the compressor runs 40% of the time (3,500 hrs full load amps, line-to-line voltage and power factor are all measured in this case. Electricity cost is $ The monthly demand charge is $10/kW - the overall average cost of electricity with demand charge is approximately $0.095/kWh.

Full load amps = 280 amps
Line-to-line voltage = 460volts
Power Factor = pf = 0.82

First, find the kW usage for the three-phase motor:

kW =

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[volts x amps x pf x 1.732] / 1,000 = [460 x 280 x 0.82 x 1.732] / 1,000 = 183kW

Annual Electricity Cost = kW x Hrs x Electricity Cost

Annual Electricity Cost = 183kW x 3,500hrs x $0.095/kWh

Annual Electricity Cost = $60,848

Note that in the second example, the electricity measurements are made in the circuit leading to the compressor motor, so that the full power usage is measured. However, the motor efficiency is still a f when one considers a possible motor change out, as noted in example one.

What does it cost me per CFM (cubic foot per minute of compressed air)?

Example 3:

The following provides a ballpark estimate for a typical compressor running 6,000 hours annually, as 90% efficient motor and that a typical compressor produces 4 CFM per 1hp. Electricity cost is assum $0.08/kW.

1CFM = 0.25hp = 0.25hp/0.90 x 0.746kW/hp = 0.207kW

1CFM = 0.207kW (assuming a 90% efficient motor)

Annual Electricity Cost for 1 CFM = kW x Hrs x Electricity Cost

Annual Electricity Cost for 1 CFM = 0.207kW x 6,000hrs x $0.08/kWh

Annual Electricity Cost for 1 CFM = $99.50 approximately $100/CFM

Other Compressor Costs

Don't forget to factor in equipment capital costs, maintenance costs, water supply costs (for water co units), and any overhead costs for floor space, insurance etc.

Conclusion

Compressors are expensive to run!! Compressed air is necessary for many plant processes, but it is inefficient source of energy. You need 7 to 8hp of electrical power into the compressor to operate a 1 motor. The overall efficiency of a typical compressed air system can be as low as 10 to 15 percent! I that your system is well designed, operates in an efficient manner, and system leakage is minimized.