CALCULATION GUIDE

Valuing Minimized Equipment Runtime

The steps below will walk you through a process for estimating the potential energy cost savings from shutting off a piece of unused equipment, in this case a motor that can be powered off safely for four hours each workday. These steps can be used with other types of equipment and systems.

Key Variables

The following are variables typically used in valuing reducing run time on motor driven equipment.

Power: horsepower (hp)

Operating time: hours

Electricity usage: kilowatts (kW) and kilowatt-hours (kWh)

Energy costs and savings: dollars ($)

Step 1: Find Equipment Specs

You will need information about the power and efficiency of the equipment you want to shut down. Look on the equipment itself, review equipment documentation, or consult maintenance staff or vendors.

In the case of motors, many are stamped with a nameplate with power and efficiency specifications required by the National Electric Manufacturers Association (NEMA). These NEMA nameplates provide useful information for calculating potential energy savings.

Your turn:

Equipment/system to be turned off: ______________________________

Step 2: Estimate Power Usage in Kilowatts

Using the equipment specs from Step 1, estimate equipment or system power usage in kilowatts. This may be straightforward or may require additional information and calculations. Your utility or energy efficiency program provider may be able to assist you with these calculations or supply you with diagnostic tools that make measuring or estimating power usage easier.

Motor power can be measured using its amperage, or by taking information from its NEMA nameplate and doing a couple of quick calculations. In the case of our sample motor, we can get from its NEMA nameplate its power (40 hp) and efficiency (94.5 percent). However, we have to consider its loading, or the burden placed on it to convert electrical energy to mechanical energy to act upon a mechanical load (such as spinning a compressor fan or moving a conveyor belt). Loading reduces a motor's actual power output from its rated power.

Let's assume our sample motor is 80 percent loaded. This means its power output is not its full rated power of 40 hp but is instead 32 hp (since 40 hp x .8 = 32 hp). Since we know the motor is 94.5-percent efficient, its input power usage (in hp) is:

32 hp / 0.945 = 33.86 hp

Since electricity units and usage are measured in watts (or kilowatts) and kilowatt-hours (kWh), we'll need to convert our motor's input power usage from horsepower to kilowatts. There are 0.746 kW in each horsepower, so:

33.86 hp x 0.746 = 25.26 kW

If NEMA nameplate information is unavailable, some general motor efficiency rules of thumb can be used. Most newer motors 10 hp and above have good efficiencies—90 percent or better when at least moderately loaded. At 5-10 hp, motor efficiency is around 88-90 percent. The efficiency rating is the power out of the motor divided by the electricity power entering the motor. Generally, motors that are loaded at 5 percent or less of their capacity lose efficiency rapidly. You may want to consider downsizing these motors to better reflect the real loading.

Your turn:
Estimated power usage of equipment or system: ______________________________ kW

Step 3: Obtain Kilowatt-hour Cost

Find your facility's electricity cost per kilowatt hour by reviewing your monthly or annual electricity bill or by contacting your electricity provider. Electricity rates can vary regionally; in the Pacific Northwest, an average cost for electricity for manufacturing sites is about $0.05/kWh.

Your turn:

Kilowatt-hour cost: $______________________________ /kW

Step 4: Calculate Estimated Savings

Plug the data collected in the previous steps into the following formula to calculate estimated savings.

Estimated savings = Power usage (kW) x Shutdown time (hours) x Electricity cost ($/kWh)

To calculate shutdown time, multiply the number of hours the equipment or system will be shut down per day times the number of days per year it will be shut down (or just use 365 days for a rough estimate). For our sample motor, for example, we know it can be shut down safely four hours a day. Multiplying four hours a day times 365 days a year gets us 1,460 hours of shutdown time.

We can now plug all of the information for our sample motor into the formula:

Estimated savings = 25.26 kW x 1,460 hours x $0.05/kWh

Estimated savings = $1,843.98

Turning off our motor for four hours each day will save about $1,844 in electricity costs over the course of a year.

Your turn:

Power usage: ____________________ kW

Shutdown time: ______________ hours

Kilowatt-hour cost: $______________________ /kWh

Estimated savings = Power usage (kW) x Shutdown time (hours) x Electricity cost ($/kWh)

Estimated savings = ______________ (kW) x ______________ hours x ______________ $/kWh

Your estimated savings: $______________________

Additional Resources

NEEA Resources

Other SEM Hub tutorials. Check out other tutorials on the SEM Hub website that can help you learn and apply SEM at your facility and calculate their estimated savings. In particular, you may wish to view the tutorials on:

- How to Get and Record Energy Data
- How to Perform an Energy Audit
- How to Estimate Costs for Energy Projects
- How to Convert Measurements to Common Units

Toolbox Talk cards. Print-ready talk cards outlining a variety of strategic energy management (SEM) tools, approaches and methods for both industrial and commercial facilities.

Other Resources

Your utility or energy efficiency program provider. Check with utility or program representatives for any assistance, solutions, or incentives they offer for measuring and reducing equipment and system energy usage and implementing other O&M best practices that support energy-efficiency goals.

Smart Buildings Center. This Seattle-based regional energy efficiency solutions provider offers education, training and resources for building engineers, managers and operators, including a lending library of measurement and diagnostic tools for energy efficiency and demand-reduction projects.