Calculating Energy Usage & Costs

Energy equals power times time. Power is the work input. For a lighting system, the power is the wattage of the system. A 60-watt incandescent lamp uses 60 watts of power to operate. Since utilities measure usage for an entire building, they use kilowatts or thousands of watts. So a utility would measure the 60-watt lamp as .06 kW. Utilities refer to the monthly kW reading as ***demand***.

Utilities factor in the amount of time power is used, typically in hours. So, energy is the measure of power used, measured in kilowatts per hour, or kWh. For example, if the 60-watt lamp operates for ten hours a day, then it will use 60 watts times ten hours divided by 1000 watts/kW or 0.6 kWh per day. Most utilities charge residential and small commercial customers only for the energy, or kWh, they use in a month. However, for larger commercial and industrial customers, most utilities will base the charges on both the energy and the monthly demand reading.

It pays to be familiar with the specific rate schedules in order to understand energy billing. Utilities base the *demand charge* on the highest fifteen or thirty minute average demand that occurs during a month. Sometimes a rate schedule is set up to include a " *billing demand*". The billing demand is the highest of either the current month's demand or a percentage of the highest demand from the previous eleven months. Demand is a very real component of a utility bill and will impact the costs and savings of lighting projects.
Here are a few examples of how to calculate energy and cost savings on electric bills from the installation of energy efficient lighting.

Example 1

A small commercial customer replaces 100 to 60-watt incandescent lamps with 100 15-watt fluorescent lamps. The lamps operate eight hours per day, five days per week, year round. Their utility charges them $0.08/kWh.

To calculate the energy savings, just figure the difference between the existing energy usage and the proposed energy usage.

Existing Energy Usage = The Power *x* The Hours of Operation

100 lamps times 60-watts per lamp times eight hours per day times five days per week times 52 weeks per year divided by 1000 watts per kilowatt equals 12,480 kWh per year. The Proposed Energy Usage would equal 100 lamps times 15-watts per lamp times eight hours per day times five days per week times 52 weeks per year divided by 1000 watts per kilowatt equals 3,120 kWh per year.

The Energy Savings would equal the existing energy usage 12,480 kWh/year minus the proposed energy usage 3,120 kWh/year or 9,360 kWh/year. To calculate the cost savings, just multiply the annual energy savings times the charge per kWh for electricity (eight cents in this case).

9,360 kWh/year *x* $0.08/kWh = $748.80/year

Example 2

Let's take this same scenario, but this time let's assume there is an energy charge of 4 cents per kWh and additional demand charge of $9.75/kW. The annual energy savings is unchanged. We need to calculate demand savings so that we can calculate demand cost savings.

Demand Savings = Existing Demand - Proposed Demand

* The existing demand equals the power 6 kW, or 100 lamps times 60-watts per lamp divided by 1000 watts per kilowatt.
* The proposed demand equals 100 lamps times 15-watts per lamp divided by 1000 watts per kilowatt, or 1.5 kW.
* The demand savings equals 6 kW minus 1.5 kW, or 4.5 kW. Since the utility measures demand each month, the demand savings is 4.5 kW per month. The energy cost savings are the same as before, 9,360 kWh per year times $0.04 per kWh equals $374.40 per year. The demand cost savings is the demand saved per month times 12 months per year times the cost per kW demand. So, 4.5 kW per month times 12 months per year times $9.75 per kW equals $526.50 per year.

$374.40 per year + $526.50 per year = $900.90 per year.

Example 3

If a customer's maximum or peak demand occurs at 2:00 PM because of air conditioning, and the lights are operating on a time clock from 6:00 PM to 6:00 AM, then the lights do not contribute to the peak demand. Making a change to the lighting demand does not affect the customer's demand charges. For example, the previous situation of 100 lamps being changed would save only energy costs, not demand if these lamps are located outdoors and operate only at night.

The total cost savings would be only the energy savings calculated previously:

$374.40 per year

Conclusion

It is important to understand how electricity for lighting is billed by the utility to accurately calculate the cost savings. These three examples show how electric rates affect cost savings. In all three, the customer changed out the same equipment, yet the cost savings is significantly different.