OFFICE OF TECHNICAL ASSISTANCE & TECHNOLOGY

KEEPING MASSACHUSETTS GREEN AND LEAN

Understanding Your Electric Bill: Saving Money On Demand Charges and Power Factor

Introduction

Massachusetts manufacturers have a number of opportunities available to them to reduce the cost of electricity. These include financial incentives to implement energy efficiency measures and install renewable energy technologies; facilities also have the ability to reduce overall monthly demand charges. OTA is providing this fact sheet to help manufacturers better understand their electric bill so they can save money by reducing demand charges and improving operating efficiencies in their use of electricity.

Demand Charges

While businesses can realize cost savings through traditional energy efficiency measures, additional cost reductions can be achieved by lowering monthly demand charges. Every electric bill that your facility receives includes charges for both electricity use and ***electric demand***. Electricity use is measured in kilowatt-hours (kWh), and reflects the consumption of electricity over a given period of time–typically a month. Demand charges are based on the peak demand (maximum rate of electricity consumption in kilowatts (kW)) at your facility each month over a specific time interval, typically 15, 30 or 60 minutes. The higher the peak consumption over the demand interval, the more you will pay in electric demand charges on your bill.

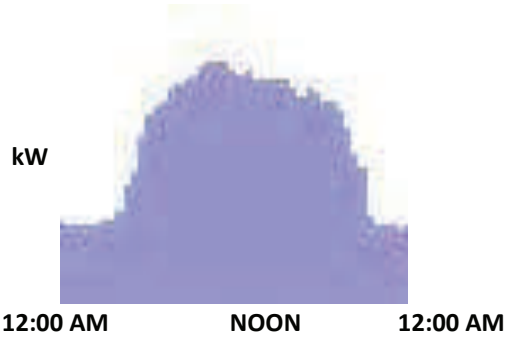
> ***Electric demand*** *is the measure of the peak or maximum rate of electricity use (kWh/hr) over a given period of time, and is expressed as* ***kilowatts (kW)****.*

The specific time interval and definition for the electric demand that is used in calculating the demand charge on your monthly bills is found in your electric rate that can be obtained from your utility's website. The electric rate typically appears on your monthly bill as a code with the title of the rate (for example "Time of Use – G-3"). The unit demand charge, defined as dollars per kilowatt ($/kW), is usually shown on your monthly bill, and is documented in your electric rate. Peaks in demand can be caused by large current draws, such as the starting of large motors, turning on induction furnaces or the use of compressors or ovens.

To help you to better understand your electricity use and to control demand, it is suggested that you analyze your daily load profile to learn how electricity is used within your operations over time (see Figure 1). This will allow you to identify ways to reduce demand. Some suggestions for reducing electric demand include:

- Extend or stagger the time when your equipment is started up to minimize the peak usage over the time interval on which your demand is based.
- Use soft starters on your larger motors to reduce current draw during start-up.

Another benefit to evaluating your load profile is the ability to identify and reduce wasted electricity use (e.g., if electricity is being used at times or days when it's not needed).



Your daily ***load profile*** *shows the energy use by time of day.*

Figure 1

Sources of Load Profile Data

Specific load profile data can either be obtained from your electric provider or from an interval recording meter installed at your facility.

- National Grid customers can subscribe to a load management tool called Energy Profiler Online™ to access their facility's interval load data online to help in understanding how electricity is used within their operations over time. For example, you can review load profiles by day, week and month, view usage history, and identify opportunities to shift energy usage to lower-cost time periods. Detailed information is available on National Grid's website: - https://www.nationalgridus.com/masselectric/business/programs/3_energy_profiler.asp.
- Eversource customers who use more than 300 kW per month can use the load management tool, Energy Link, to access their load profile data on a 15 minute delay for use in analysis, reducing peak demand and planning on their website: https://www.eversource.com/content/ema-c/business/save-money-energy/energy-efficiency-tips/energy-link
- Unitil or municipal provider customers should contact their provider to determine whether they can supply your load data to you. If so, ask in what time interval it would be reported (it's commonly reported in 15 minute intervals).

(Over)

Power Factor

The power factor at your facility may be considered by your electricity provider in determining the demand, for billing purposes, that is used in calculating your monthly demand charge. This can have a significant impact on your total demand charges and your monthly electricity bill!

While your power factor may vary over time, generally speaking, a high power factor indicates effective utilization of electrical power, while a low power factor indicates poor utilization. Power factor is expressed as the ratio of kW to kVA (kilovolt-amperes) delivered by your electric provider.

Low power factor is caused by inductive loads, such as transformers, high-intensity discharge lighting, and electric motors operated at less than full load (which often occurs in cycle processes such as conveyors, compressors, and HVAC fans). The electric providers in Massachusetts typically require a power factor of 90% or above, which means that the ratio of kW/kVA should be > 90%. The effect of having a power factor below the minimum stipulated by your provider will be that you will pay more in demand charges than you would if the power factor was above the required minimum. This extra amount is charged by a utility so they can recover their costs for maintaining a good power factor on their distribution system.

Power Factor

The **power factor**[1] of an AC electric power system is defined as the ratio of the real power flowing to the load (in kW) to the apparent power in the circuit (in kVA), and is a dimensionless number between 0 and 1. **Real power** is the capacity of the circuit for performing work in a particular time. **Apparent power** is the product of the current and voltage of the circuit. Due to energy stored in the load and returned to the source, or due to a non-linear load that distorts the wave shape of the current drawn from the source, the apparent power will be greater than the real power.

Tips to Improve Your Power Factor

- Add power factor correction capacitors (also referred to as a capacitor bank) to the plant electrical distribution system.
- Install equipment with good power factor, e.g., adding a variable frequency drive (VFD) to a lightly or variably loaded induction motor.

While the monthly facility power factor is usually not specifically shown on your bill, it is likely that power factor is considered in determining your demand if you see both peak kW and peak kVA stated on your bill. You can confirm whether your provider considers power factor in determining the monthly demand (kW) charge and, if so, what their minimum required power factor is, by consulting the definition of demand charges in your electric rate, or contacting your provider. Tips to improve your power factor are shown in the box to the left. Please keep in mind, however, that if **your power factor is already above the minimum level required by your provider, increasing it further will not reduce your demand charges.** Also, it is not necessary to correct your power factor if it is not considered by your electricity provider in determining your demand charges.

Additional information on power factor is provided in DOE's tip sheet Reducing Power Factor Cost - http://www1.eere.energy.gov/manufacturing/tech_deployment/pdfs/mc60405.pdf

Technical Assistance Options

Improving load management and power factor, if necessary, can help you reduce your demand charges and, therefore, your total electric costs. OTA is available to evaluate your electric bills to assess the magnitude of your demand charges, and determine whether you are being penalized for a low power factor.

1. http://en.wikipedia.org/wiki/Power_factor#cite_note-0

The Office of Technical Assistance and Technology (OTA) has developed a series of fact sheets on Resource Conservation practices and issues. To see the other fact sheets please visit the OTA website. OTA is a non-regulatory office within the Executive Office of Energy and Environmental Affairs (EEA) that provides a range of non-regulatory assistance services to help businesses cut costs, improve chemical use and energy efficiency, and reduce environmental impact in Massachusetts. For further information about energy efficiency and renewable energy, or about OTA's technical assistance services, contact:

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