Best Management Practice Guide

Demand Management

Introduction

Electric utilities must provide power in real time. This can be tricky because power usage fluctuates as utility customers go through their daily routines and as weather changes. However the utility company must constantly provide power and meet the community's electricity needs every second of every day. That electricity need is called demand.

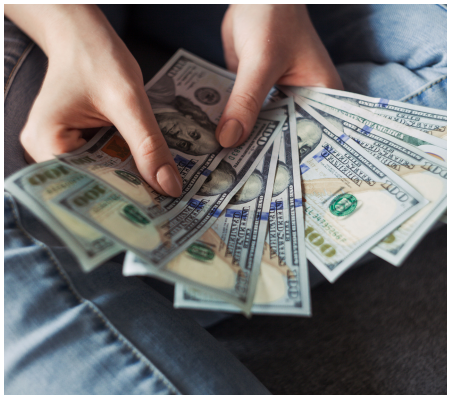
When demand is greater than the power available, it places a strain on the utility system. Therefore, many utilities add a demand charge to the bills of large customers to offset differences between supply and demand. These demand charges can account for more than 50% of a business's monthly electricity bill. Thus understanding and managing demand should be an element of a business's energy management program.

Understanding Demand

Electric bills have two metered items: demand and energy. Energy is the flow of electric charge through a conductor over time while demand is the power being consumed at a given time. Check the units of measurements to make sure you know what you are looking at. Demand is recorded in kilowatts (kW) or kilovolt-amperes (kVa) while energy is measured in kilowatt-hours (kWh).

Demand is instantaneous and depends on how much electricity-consuming equipment a facility runs simultaneously. When a location operates multiple pieces of equipment at the same time, the electric demand requirements for all are added together.

The current rate at which electricity is being used at the distillery/brewery is actual demand while the highest rate during a billing period would be maximum or peak demand. Utilities can bill customers for their maximum demand on top of their electric usage (kWh).



Demand charges can account for more than 50% of a customer's monthly bill.

Demand is the rate at which electric energy is being consumed at a point in time.

Need Help...

- *establishing an energy program,*
- *training a team,*
- *or educating employees about energy bills?*

Contact the
Kentucky Pollution Prevention Center!

Website: www.kppc.org
Email: info@kppc.org
Phone: 502-852-0965

Demand Management

Demand management requires manipulating load demands from the consumer end (i.e. controlling the amount of equipment consuming electricity and when equipment is used). This can be achieved by adjusting electricity usage behaviors, developing better energy use plans and participating in incentive programs offered by your utility. Together this equals a significant amount of monitoring and control, on top of understanding tariffs and communicating with your utility.

Rate Class

If you have looked at your household electric bill of late, you probably did not notice a demand charge. This is because power utility companies classify electric service according to rate class. A rate class is a group of customers that have similar usage characteristics. There are three basic rate classes: residential, commercial, and industrial. Demand charges are generally applied to commercial and industrial customers, not residential consumers.

Tariffs

Most utilities in Kentucky are regulated by the Kentucky Public Service Commission (KPSC); the exceptions are Tennessee Valley Authority (TVA) supplied cooperatives and municipalities. Utilities regulated by KPSC must file their tariffs to be reviewed and approved by the KPSC. While tariffs for municipal utilities are approved by the local authority, such as a local board or commission. Tariffs outline the service agreements between the customer and the utility, including billing and payment information, as well as the rights and responsibilities of each party in the agreement.

Find your tariff online in Kentucky Public Service Commission's Tariff Library!

Visit: https://www.psc.ky.gov/Home/Library?type=Tariffs

Rate Plans

It is important to understand tariffs because how a customer's electric bill is calculated is directly linked to a specific tariff. These rates differ across utilities and are calculated depending on the customer's rate plan. Rate plans specify the rules for how customers' bills are calculated. Utilities typically offer multiple types of rate plans. Common rate plans include:

- *Time of Day Rates* represent charges based on the time of day. Flexibility in scheduling is key here. You can schedule activities to take place during a specific time of day, when charges are low.
- *Temporary or seasonal rates* are applicable to customers who have seasonal operations.
- *Curtailment rates* represent a customer's load that can be decreased by the utility or curtailed at a moment's notice. These rates are typically offered at a discount on the understanding that a utility could reroute that energy to another customer without notice.
- *Demand Response* represents a financial opportunity for customers to reduce or shift their electricity usage during peak periods in response to some form of financial incentives. Demand response programs may not be offered by all utilities.

Review Your Options

Customers may pay more or less for the same amount of electricity under different plans. Review the available rate plans to see if you fit the criteria for a lower cost rate structure. A new rate plan may be more cost effective, depending upon your situation. Example: your building once was a large manufacturing building but now is a warehouse, you may be on an old rate plan that charges a flat rate for a higher demand than you use. Contact your utility company to discuss and/or change your current rate plan. Make time to review your current tariff and rate plan to see if and how demand charges are applied.

Demand and Rates

Understanding how demand is calculated by the utility can help breweries and distilleries determine how their actions affect their facility's electric bill. Below are a few ways which a facility may be billed for demand.

- *Actual Demand* is a charge based on actual demand used at the facility.
- *Ratchet Demand* is a charge based on the maximum demand of the previous billing cycles. Typically the maximum demand of the previous 11 months is used. The charge will be for the maximum set by the tariff even if the current month's is lower.
- *Contract Minimum Demand* is a demand minimum set by the utility company based off of expected operations.
- *Time of Day Demand* is when demand data is recorded throughout the day, normally in 15 or 30 minute intervals. The maximum demand is recorded for different time periods during the day which are often base, intermediate, and peak. These can change seasonally.
- *Low Power Factor* is the ratio of actual power used in a circuit to the apparent power delivered to the circuit. It is an expression of energy efficiency. A low power factor requires a higher current to supply the loads, thus increasing the overall operating cost. Some utilities apply a surcharge for low power factors.

Did You Know...
A facility's environmental compliance requirements can be impacted by making changes like changing out equipment,using a new product in your process,etc.

The Environmental Compliance Assistance Program is here to help!

Email: envhelp@ky.gov
Phone: 502-782-6189

Use Your Energy Bill

For proper demand management a facility must first analyze the demand requirements of its equipment. To do this, collect and graph demand data from at least (12) twelve consecutive billing periods. Look for patterns in your demand data. Also, ask and answer key questions like:

- Is the demand charge based on the actual demand or a ratchet?
- Does the peak occur at a specific time(s)?
- Is it necessary for the peak to happen then?
- Does it match production schedules (lunch breaks, downtime, etc.)?
- Does it match climate or weather patterns?
- What is the base demand(i.e. demand that is required at all times) ?
- What is the minimum demand requirement?
- What equipment truly needs to operate simultaneously?
- What equipment can have staggered operating schedules?

Load Shifting

While analyzing your data, double check for a large peak or peaks in demand that constantly occurs during a certain segment(s) of time or equipment operation schedules. If this is happening, you may want to pursue load shifting. The purpose of load shifting is to reduce your maximum demand. Load shifting can be achieved by methods like:

- Staggering the start-up of machinery that require high-demand.
- If possible, shift large demand loads to low-activity periods like overnight or early morning.
- Try not to simultaneously operating multiple pieces of equipment with high-demand requirements.
- Avoid unnecessary energy use, especially during periods of time when demand is high. For example, do not leave the lights or pieces of equipment which are not in use.

Methods and Solutions

After reviewing your demand data, an in-depth report should be written and a summary circulated internally. Address these items with the appropriate department teams. While doing this, it is important to remember that demand is not a function of run time. It is a function of the power requirements of an individual piece of equipment and how much equipment is on at any given time. Therefore facilities can control demand by:

- Installing energy efficiency equipment that reduces the rate of consumption.
- Right-sizing equipment to fit the job.
- Rescheduling energy-intensive activities for lower load times of the day.
- Conducting scheduled startup of high energy-intensive equipment to reduce peak demand, especially at the start of the work day or shift.
- Looking at energy storage solutions that allow for shifting loads.

Implementing Change

Develop and implement an action plan. One way to achieve this is by using a team approach. The team approach can be one team per facility or a network of teams. A team approach assists with buy-in from all levels of the organization. Full management support is key for success. If workers feel that management is disrespectful to their efforts, there will be a reluctance to continue which will ultimately derail the objective.

Recognition Opportunity...
Kentucky Excellence in Environmental Leadership (KY EXCEL) is a program that recognizes environmental achievements throughout Kentucky.

*For details, contact **KY EXCEL!***

***Email**: envhelp@ky.gov*
***Phone**: 502-782-6189*

Recognize Achievements

Take time to internally recognize the contributions of teams and individuals. This helps to reinforce the value of sustainability, encourages greater improvement and maintains motivation. External recognition from a third party validates the importance of sustainability endeavors, provides satisfaction to those who earned the award and enhances the company's public image.

Summary

Let's recap. Demand is the measure of the amount of power used to run machinery and equipment during a certain period of time. When demand is greater than the power available, it places a strain on the utility system. Therefore many utilities add a demand charge to the bills of large customers to offset differences between supply and demand. Thus understanding and managing demand should be an element of a business's energy management program. By understanding how your facility and equipment operates, it is possible to manage demand by adjusting electricity usage behaviors and developing better energy use plans. Also, make time to talk to your utility about how incentive programs, rate plans and tariffs impact your facility's demand management efforts and electric bill.

Additional Resources

Kentucky Pollution Prevention Center
Sustainable Spirits and Brewing Initiative

- *http://kppc.org/ksmi/ssb/*
- info@kppc.org
- 502-852-0965

Kentucky Division of Compliance Assistance
Kentucky's Sustainable Spirits Initiative

- *https://eec.ky.gov/Environmental-Protection/Compliance-Assistance/Pages/sustainable-spirits.aspx*
- *envhelp@ky.gov*
- *502-782-6189*

Kentucky Divison of Compliance Assistance

Produced by the Kentucky Pollution Prevention Partnership (KP3) thanks to US EPA Pollution Prevention Grant Funding

Demand Basics

To manage electricity, a business must not only know how much is used but also understand a facility's demand. To help, look below for some basic points.

DEFINED

Demand is the measure of the amount of power used to run machinery and equipment at a specific point in time. When more than one piece of equipment is operating at the same time, the total demand is cumulative.

When demand is greater than power available, it places a strain on the utility system.

For most utilities, demand is calculated based on the average load placed within 15 to 30 minutes.

Peak or maximum demand is the point at which demand is at its highest. Utilities may bill for peak demand because it is challenging for them to anticipate and deliver power to everyone's peaks.

MEASUREING DEMAND

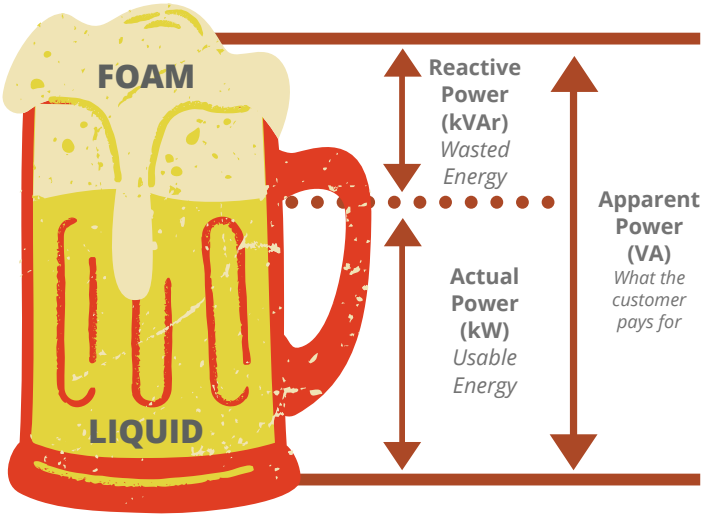
Demand can be recorded in kilowatts (kW) or kilovolt-amperes (kVA). KW is the measurement of *actual power* (i.e. the power necessary to run equipment), while kVA is the measurement of *apparent power* (i.e. the power necessary supplied by the utility based on the facility's power factor).

POWER FACTOR

Power factor (PF) is an expression of energy efficiency and is the ratio of actual power used in a circuit to the apparent power delivered to the circuit.

PF is measured on a scale from 0 to 1 and is often expressed as a percentage. The lower the percentage, the less efficient power usage is (e.g. a 96% PF represents more efficiency than a 75% PF).

A PF equal to 1 (or 100%) would reflect a perfectly efficient system where all apparent power is converted to actual power. Note: no system is completely efficient.



ANALOGY: Imagine a freshly poured beer. The top is foam, while the bottom is liquid. You pay for the whole beer, but drink only the liquid. The liquid is actual power (kW), while the whole beer is apparent power (VA). To convert kW to kVa, you need to know the power factor or efficiency of a system (i.e. the ratio of liquid to beer.)

Explained Another Way

$$\text{POWER FACTOR} = \frac{\text{ACTUAL POWER (KW)}}{\text{APPARENT POWER (VA)}}$$

The efficiency of an electrical system's ability to convert apparent power into actual power is expressed by a power factor.

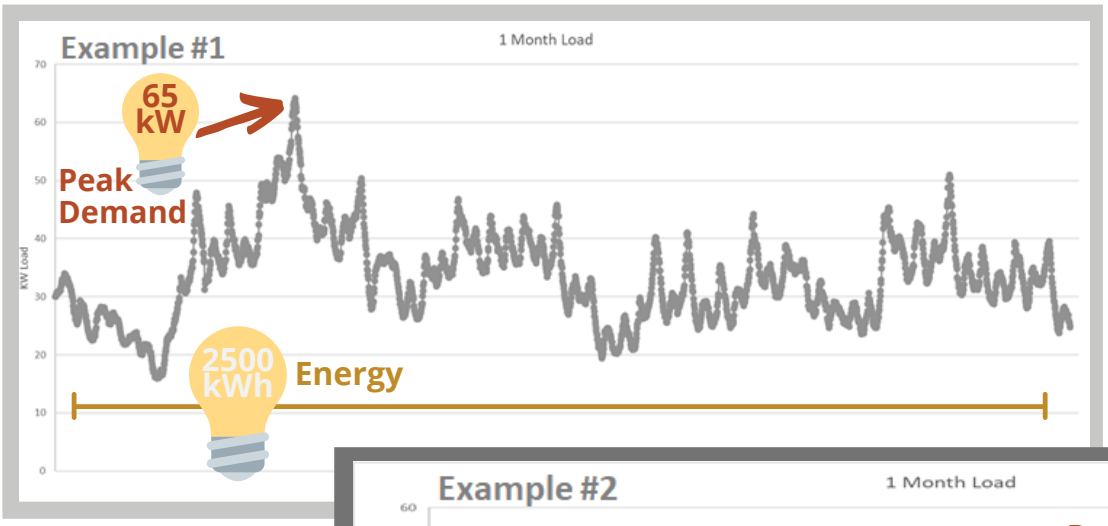
Poor power factor matters to companies because it can result in:

- Reduction in the amount of available usable power.
- Requires a higher current to supply loads, due to less usable power.
- Higher overall operating cost, due to a higher current requirements.
- Potential surcharges applied to electric bill by the utility.

Kentucky Divison of Compliance Assistance
300 Sower Boulevard, 1st Floor, Frankfort, KY 40601
Assistance Hotline: envhelp@ky.gov | 502-782-6189

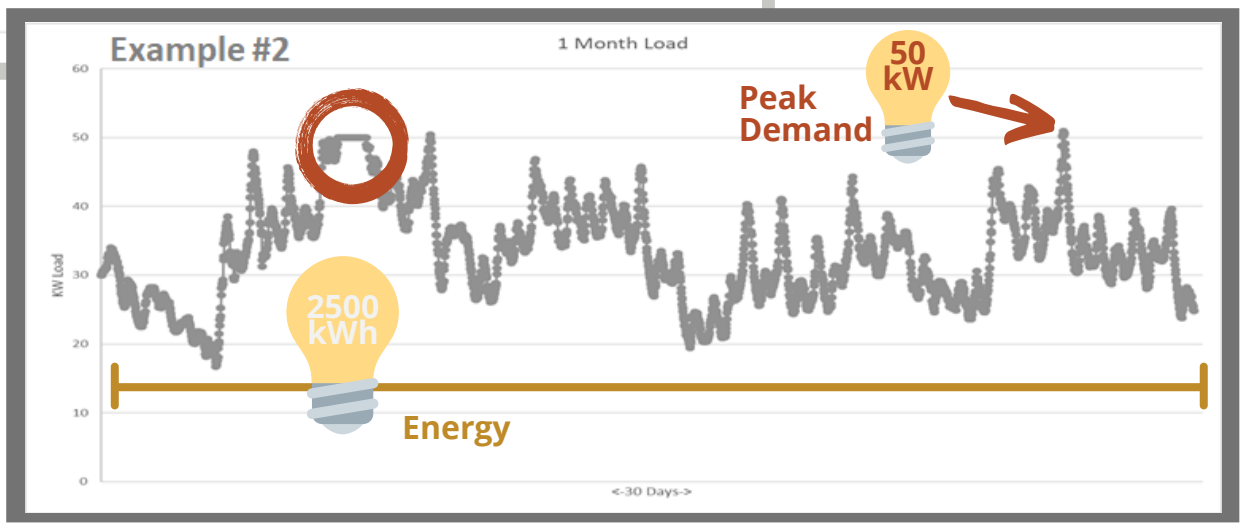
Load Shifting Overview

Peak demand and energy costs can be reduced by load shifting. Look below for some "how-to"details.



Analyze your electricity use data for patterns. There may be a large peak during a consistent segment of time.

If this is occurring, you may want to pursue load shifting methods. The purpose of load shifting (i.e. load balancing, shedding, etc.) is to reduce your maximum or peak demand.



In both examples above, the customer consumed 25,000 kWh in a 30 day billing period. Therefore the energy charge in both examples would be the same. In the top example, the customer's peak demand is 65 kW while the peak demand was reduced from 65 kW to 50 kW by shifting the energy load. By simply shifting the energy load to reduce the peak demand, our example customer save on demand/electric costs during a 30 day billing period.

POSSIBLE STRATEGIES

- Staggering start-up of high-demand machinery
- Shifting large demand loads to low-activity periods if possible (for example, overnight or early morning)
- Avoiding simultaneous use of multiple high-demand equipment
- Avoid unnecessary energy use (i.e. leaving the lights on, etc.) especially during periods of high demand

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