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Understanding Electricity Bills

Guidance for Nebraska Businesses and Municipalities

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This publication is intended to help business owners and municipal managers understand the different types of charges in their electricity bills. By understanding these charges, they may be able to identify ways to reduce their electricity costs.

Important Information on Electric Bills

Each utility bill looks different.

- Charges and fees differ, subject to the energy provider.
- Rate schedules will be different depending on the provider and the type of customer. Customers may be classified as general service, irrigation, residential, or industrial customers, or may be classified under one of numerous other labels. Similar companies in the same region may even have different rate structures depending on their usage and demand.
- Rates could also vary within the same energy provider based on the season. Winter months (October-May) may be charged at a lower rate than summer months (June-September).

Depending on the rate structure, the components discussed subsequently may be present in your bill.

Define Key Terms

Table I is an example of an electric bill based on the format of a bill from a manufacturing facility. It contains many of the charges that business and municipal managers may see on a bill. There should be a separate place in the bill or a separate bill entirely for each meter. It's a good idea to check that the meter numbers on the bills match your facility's meters.

Table I. Example of a manufacturing facility electric bill

Meter #534978

Meter Read	Kilowatt-hours	Current kW	Min Billing kW	Load Factor	kVar	Allowed kVar	Excess kVar	Power Factor
08/04/2016	470,600	986.40	650	66.5%	482.60	394.56	88.04	89.83%
Customer Charge	Energy Charge	Ratcheted kW Charge	Total Demand Charge	kVar Penalty	Bill Amount	Taxes and Other Charges	City Dividend	Current Bill
$250.00	$12,470.90		$13,617.50	$228.47	$26,566.87	$0.00	$775.98	$27,342.85

Usage/Consumption Terms and Charges

Electricity providers charge all their customers for their electric usage/consumption. You will see some, if not all, of the following terms on your bill.

Meter Read

The first term is "Meter Read." This is the date that your meter was read. When it is read, all the information from the past month is gathered and shown as you see in *Table I.* Sometimes, utility bills will even show the meter readings at the beginning and end of the billing period. These readings will have labels such as "From" and "To."

Kilowatt-hours

"Kilowatt-hours" or usage is the energy used during the billing period. Kilowatt-hours are often abbreviated as "kWh." One kilowatt-hour is equivalent to running a 1,000-watt piece of equipment for one hour. In Nebraska, the cost per kWh for industry is often lower than in other regions, typically between $0.025 and $0.08 per kWh. It can be calculated as:

$$Energy\ Charge\ \left(\frac{\$}{mo}\right) = Usage\ \left(\frac{kWh}{mo}.\right) x\ Usage\ Rate(\frac{\$}{kWh})$$

In some cases, electricity providers may charge a portion of the usage at one rate and another portion of the usage at another rate. Other terms may be "kWh used" or "consumption." (Technically, energy can't be consumed, just converted. However, those terms are used because consumers think of consuming energy the same way they consume water or gas.)

Multiplier

Many meters do not show energy use in kilowatt-hours. In these instances, you can multiply the change in the meter reading by a specific number, which is called the "Multiplier," to find the kWh energy usage. Managers frequently make mistakes in understanding their utility bills because they don't know or understand the multiplier. The following equation shows how to calculate the kWh usage using the multiplier.

$$kWh = (Ending\ Meter\ Reading - Beginning\ Meter\ Reading) \times Multiplier$$

The example bill does not have a multiplier.

Energy Charge

The "energy charge" is the cost of your energy usage. This cost is calculated as:

$$Energy\ Charge = Usage\ \times Usage\ Rate$$

Nebraska usage costs are typically 40 to 50 percent of the total electrical bill for industrial customers.

In many cases, the energy charge includes the transmission/distribution charges. Although not as common, sometimes the energy charge and transmission/distribution charge are separated. In that case, there is a separate rate for the transmission/distribution per kWh.

Demand Terms and Charges

Most commercial and industrial facilities will find demand charges on their bill, but some residential and small municipal customers do not get charged for their electric demand.

Current Demand

"Current kW" is the demand. Demand is the maximum amount of electric power that the customer draws at one time during a set time frame. As with usage, the rate schedule can vary, but it usually varies for on- and off-peak times. This means that charges are different based on the time of day the electricity is used. On-peak charges are higher than the off-peak charges. Rarely do demand rates vary seasonally. In Nebraska, demand rates can often vary between $10/kW and $20/kW. In the example bill, the demand rate is $20.95/kW. Also, similar to usage, some providers may charge part of the peak demand at one rate and the other part at a different rate. Basic calculations will look familiar as shown. Other terms used may include "Peak Demand," "Demand," or "Actual Demand."

$$Demand\ Rate = \frac{Basic\ Demand\ Charge}{Usage}$$

$$Demand\ Charge\ \left(\frac{\$}{mo}\right) = Usage\left(\frac{kW}{mo}\right) \times Demand\ Rate\ (\frac{\$}{kW})$$

A good analogy for the difference between kWh (energy) and kW (power) is that kWh is like the odometer in your car, while kW is like the speedometer. At the end of the billing period, the usage charge is applied to how many "miles" you put on the "odometer," while the demand charge is applied to your "top speed."

Methods to account for demand will vary by utility. For example, an alternative method used in Nebraska is to set a higher usage rate charged per kWh based on the demand. For example, $0.12 per kWh for the first 200 kWh per kW of billing demand and $0.04 per kWh for all additional use. If, for example, the business had a demand of 150 kW, the calculation is:

$$\$0.12\ per\ kWh\ for\ the\ first\ (200kWh\ \times 150\ kW) = 30{,}000kWh$$

Customer pays $0.12 per kWh for the first 30,000 kWh and $0.04 per kWh for usage greater than 30,000 during the billing period.

Multiplier

As with usage, most energy providers don't use equipment that measures demand in kW, so they use a multiplier to convert their readings into kW. The multiplier for demand is usually, but not always, the same as the multiplier for usage. The following equation shows how to use the demand multiplier.

$$kW = (Raw\ Demand\ Reading) \times Multiplier$$

Min Billing kW

"Min Billing kW" is the minimum number of kW for which you will be charged. That is, if you maintained a low peak demand that was under the minimum billing kW, you would still be charged for the minimum kW listed. The minimum kW usually changes based on the month or season, depending on the energy provider. Another term may be "Billing Demand."

Ratcheted kW Charge

"Ratcheted kW Charge" is a charge based on the highest monthly demand experienced for the year, which is also the annual peak. If the provider applies a ratcheted charge, the minimum demand charge for any month is usually about 60 percent of the annual peak. The example bill shows that the energy provider does not have a ratcheted demand charge.

Total Demand Charge

The "Total Demand Charge" is the cost of your demand usage. This cost is the amount of kW multiplied by the rate ($/kW). Nebraska facilities usually find that demand costs are around 50 to 60 percent of the total electrical bill.

Load/Power Factor Terms and Charges

Electricity providers usually only charge large commercial industrial users for things like load factor, kVar, and power factor. You may still find these metrics useful even if you do not get charged for them.

Load Factor

The "Load Factor" (LF) indicates how much your electrical load varies throughout the month. The load factor can be found with this equation:

$$Load\ Factor = \frac{Usage\ (kWh)}{\left(\frac{\#\ of\ days}{month}\right) * (24) * \left(Peak\ Demand\ (kW)\right)}$$

where 24 represents the number of hours in a day. Most businesses and utilities do not need a thorough understanding of load factor. Just know that load factor is a number between 0 and 1 (or 0 and 100 if expressed as a percentage). A high load factor means that your demand stays fairly steady throughout the month, while a low load factor means that the demand varies greatly throughout the month. Also, companies that run 24/7 will generally have higher load factors (about 0.9) than companies that only operate 8 hours/day, 5 days/week (about 0.25).

kVar, Allowed kVar, and Excess kVar

"kVar" is the reactive power and stands for "kilovolt amperes reactive." The "Allowed kVar" is the amount of kVar that you are allowed to use before being charged. "Excess kVar" is the difference between "kVar" and "Allowed kVar" (Excess kVar = kVar–Allowed kVar). The facility is only charged for the excess kVar. kVar is related to power factor, so the next section will better explain why kVar is important.

Power Factor

"Power Factor" (PF) essentially measures the efficiency at which you are running your electrical equipment. The most common analogy for power factor is the beer glass analogy. A power factor of 85 percent is like having a glass of beer that is 85 percent beer, while the other 15 percent is like the foam at the top–present, but not particularly

useful. Like load factor, most people don't need a thorough understanding of power factor, but if you want to calculate it, you can use these equations:

$$kVA^2 = kW^2 + kVar^2$$

$$PF = \frac{kW}{kVA} * 100\%$$

Where kVA is the apparent power and stands for "kilovolt amperes." Note that the first equation is not necessary if your energy provider uses kVA instead of kVar in the billing process.

Many energy providers add an additional charge for customers with a power factor under 90 percent. Some providers even offer credits for maintaining a high-power factor.

kVar Penalty

"kVar Penalty" is the charge based on the excess kVar, which was defined earlier. kVar charges are usually only around 1 percent of the total electrical bill.

Other Charges

Nearly all bills will have a handful of small charges at the end. These are just a few examples:

Cust (Customer) Charge

The customer or service charge is a baseline fee that energy providers charge their customers for using their services. Although this may seem unusual and unnecessary, the cost of this charge is often a small fraction of the total electrical bill.

Taxes, Dividends, and Other Charges

Energy providers may charge taxes, dividends, or other fees, which are usually implemented and collected for state and/or local governments. In the example bill, there are no taxes, but there is a city dividend.

Adjustments

Many providers have adjustments based on their fuel costs or on regional usage and demand. These vary widely between different providers, but usually make up a small portion of the bill. If you want more information about your adjustments, you will need to contact your provider. The example bill shows that the energy provider does not have any adjustments.

Bill Amount/Current Bill

Every bill should list the total amount of all charges to be paid to the energy provider. In the example bill, this is listed under "Current Bill." Some providers, such as the one in this example, show a subtotal that includes the primary charges, such as the energy charge and the demand charge, but not small charges like taxes and dividends. This is listed as "Bill Amount" in the example, and includes customer charge, energy charge, total demand charge, and kVar penalty.

Possible Questions for Your Electricity Provider

To fully understand your electric bill, be sure to ask questions. Below are some useful questions you may ask your energy provider if they are not clear from your bill.

- What is the rate structure for my business?
    - The $/kWh and/or $/kW rates may change after they reach a certain number.
    - The time frame over which peak demand is determined could be one billing cycle, one quarter, or even one year.
    - This information may or may not be listed on the bill already.
- Is there a better rate classification for my business?
- Is there a more detailed version of my bill?
- Can you provide a demand graph or profile?
    - A demand graph or profile shows what time of day peak demand occurs.
    - Most large power providers have these, but this question is worth asking regardless of the size of your electricity provider.
    - If your electricity provider cannot provide a demand profile, they still might be able to tell you what time of day peak demand occurs.
    - *Figure 1* is an example of a demand profile.
- On what time interval is my demand being monitored?

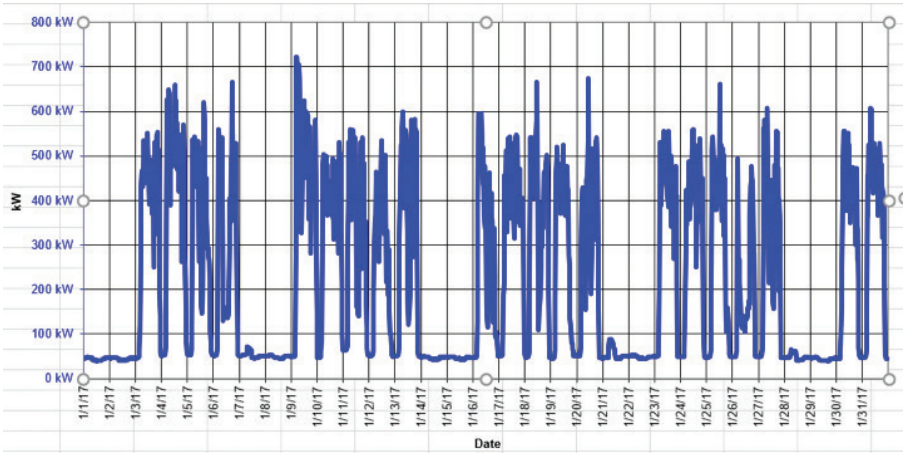

Figure 1. Demand profile example

- Going back to the car example, most utilities take your "top speed" as the "top X-minute average speed." If the time interval is small, say, 5 minutes, short demand spikes can significantly influence your demand charges. If the interval is large, say, 30 minutes, these spikes will likely have little to no influence on your demand charges.

- When are on- and off-peak demand times?
  - Any information regarding demand charging is usually included in documents related to your rate structure, and much of it is often on the energy provider's website.

These are just a few things to think and inquire about so that you can fully understand your electricity bills. If you need more information or just want a rundown of your bill, call your energy provider.

How to Reduce Costs

There are many ways to reduce costs on your electricity bill. The following actions may reduce the usage and peak demand charges, improve load factor and power factor/kVar, and minimize kVar penalties.

General Cost Reduction

- Make sure that your rate schedule is appropriate for your business, especially if your bills seem particularly high.
- Have one or more employees who use the equipment or directly oversee equipment use verify electricity charges. This will (1) help ensure that the charges from the utility company are correct and (2) increase employee awareness of energy use.

Reducing Usage Charges

- Be on the lookout for unnecessary energy uses (e.g., lights on when people aren't present, doors and windows open when heating or air conditioning is running).
- Be on the lookout for opportunities to use or install lower-wattage alternatives. Even a slow upgrade to more energy-efficient lights can have a large payback over time. This will also reduce your demand charges.

Reducing Demand Charges

Reductions in demand charges occur in two ways:

- Strategically timing when processes are active to minimize charges
- Reducing the power draw of equipment by using higher efficiency alternatives

It is important to understand the difference between on- and off-peak hours. On-peak hours are usually during the normal workday, such as 8 a.m. to 5 p.m., but vary depending on the energy provider. Off-peak hours are any other time. On-peak charges are higher than off-peak.

Here are some ways that you can reduce your demand charges:

- Avoid running all equipment at once. Instead, stagger high-energy processes.
  - Example: A fast-food restaurant found that peak demand occurred at 6 a.m.—the time when they turned on all three of their deep-fat fryers. These fryers draw a lot of electricity to heat up the oil, but not as much once they are hot. They decided to have an employee come in 30 minutes earlier each day and turn on the fryers in 30-minute intervals—one at 5:30, one at 6, and one at 6:30. The extra cost of having an employee come in early was only a fraction of the cost savings that resulted from the adjustment.

- Schedule high-demand processes and operations during off-peak hours whenever possible.
- When purchasing new machines or choosing which of your machines to use, pick the lowest-wattage alternative that will meet your needs. Don't use the 10 HP machine if the 5 HP machine will do the job. This will also reduce your usage.

Using a demand graph or profile is extremely useful in reducing peak demand charges. If you can find what time of day the peak demand occurs, you can identify which machines are turned on at this time, then stagger or strategically time those machines.

Knowing your load factor also can help you reduce your peak demand. If your load factor is high, then your demand is fairly constant without any major peaks. If your load factor is low, then there are probably ample opportunities to reduce your peak demand.

Power Factor and kVar

Power factor and kVar affect the kVar penalties. If there is a lower kVar, then the power factor will improve, and therefore reduce or eliminate the charges related to the power factor (in this case it is called a kVar penalty). You can raise your power factor by doing one of the following:

- Avoid using motors and equipment that have a heavy inductive load, which are usually machines that require a lot of energy at start-up. Low power factors are due to current and voltage being out of phase, which can be caused by these machines.
- Install a power factor correction capacitor or talk with your electrician or energy provider about a power factor correction system. The installed price for these capacitors starts at thousands of dollars, so they are usually only practical for medium and large size manufacturers with significant power factor issues.

Summary

Understanding your electricity bill and all the charges on it is extremely important. It could lead to reducing or eliminating high charges with minimal work. Calling your energy provider is always a good option if you are confused or want something explained in detail.

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