Ask an Expert

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Author	Details
	Saturday, November 07, 2009 **KVARh Billing** Question: Could you shed some light on how the KVAh billing vs KWh billing is determined and factored on RMP's commercial power bills? Also, Power Factor ratings on the billing? Do these items have a bearing on Demand Charges? Thanks Telephone: 801-656-5200
Mark Farrell Email	Monday, November 09, 2009 We want to be clear on your question since you mention kvarh in the inquiry title and kvah in your actual question. Based on your question, it appears that your interest is in kvarh. Kilovar-hour (kVarh) is defined as the amount of reactive flow in one hour, at a constant rate of one kilovar. Note that it does not have an impact on kWh or kW demand charges. It is further defined below with a graphical representation. Reactive power is measured in kilovolt-amperes: reactive (kvar) and results from equipment that draws more current from the electrical system than usual. If you see this line item on your bill, it means you have equipment that draws more current from the electrical system than usual. Examples of this type of equipment are motors, fluorescent lights and induction furnaces. Because this equipment causes greater electrical draw and has a greater impact on our electrical system, it usually requires larger transformers, wiring and additional generation. **Customers that have high demands are charged for this service**. **You can reduce this charge by turning off unused motors and**

other equipment and by installing capacitors. Capacitors help to balance and reduce the impacts these types of equipment have on the electrical system.

For Utah customers, Rocky Mountain Power measures kvarh on your meter. When motors are drawing power, more kvarh is recorded. In order to convert to kvar, some assumption on the load factor of the motors (a ratio of the amount of time that the motors are actually running compared to the hours in the billing period) is required.

Power Factor Description

If all electric loads were resistive (as in incandescent lights, resistance heaters etc), energy users would not have to worry about power factor. The electrical system would be operating at its highest efficiency. But there are also motors, transformers and capacitors that are components of electrical systems, and these devices and others create induction and capacitance. **The net effect of these inductive and capacitive devices results in inefficiency in the delivery of electricity.** The voltage and current components of power fall out of sync to some extent. When this happens, some of the energy is lost to generate the magnetic field of the motor, or the energy is lost in the creation of the stored energy for the capacitor.

The electric utility must supply more power to account for the losses incurred due to excessive inductance or capacitance. If the useful power that the energy user consumes is described as "working power" or "real power" (kW), then the component of lost power is sometimes referred to as reactive power, or kilovolt amps reactive (kVAR). The total amount of power that the electric utility has to supply to the customer is called "apparent power", and is given in kVA.

Power Factor = kW / kVA

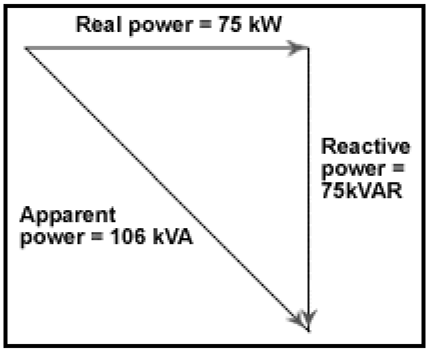
$(kVA)^2 = (kW)^2 + (kVAR)^2$

As an example, suppose that an ice skating rink has a poor power factor because of all the motors and compressors required for refrigeration equipment and blowers. If the demand meter reads 75kW and the reactive meter reads 75kVAR, the power factor calculation is as follows:

(kVA)² = (kW)² + (kVAR)²

= (75)² + (75)² = 11,250

Apparent Power = √11,250 = 106kVA



Then: Power Factor = kW/kVA = 75/106 = 70.8%

In this case, the utility has to supply the equivalent of 106kVA, while the customer is only getting the benefit of 75kW. If the power factor is improved to 90%, then the utility only has to supply the equivalent of 83.3 KVA, though the customer is still using 75 kW.
Power Factor = kW/kVA = 75/83.3 = 90%

Note that when capacitors are added to the system and kvar is reduced, the kW demand is not affected. However, KVA is reduced when power factor is improved. The power factor is never greater than one, and is usually given in percent. Unity power factor (1 or 100%) indicates that the voltage and current are perfectly in balance. However, when power factor is well below unity, a significant amount of power is wasted.

Customers of Rocky Mountain Power in Utah can reference our most common business and industrial price schedules (Schedules 6 and 8) for insight as to how low power factor is billed. For example, this is the pertinent language from Schedule 6:

POWER FACTOR: This rate is based on the Customer maintaining at all times a Power Factor of 90% lagging, or higher, as determined by measurement. If the average Power Factor is found to be less than 90% lagging the **Power as recorded by the Company's meter will be increased by 3/4 of 1% for every 1% that the Power Factor is less than 90%.**

POWER: The kW as shown by or computed from the readings of Company's Power meter for the 15-minute period of Customer's greatest use during the month, adjusted for Power Factor as specified, determined to the nearest kW.