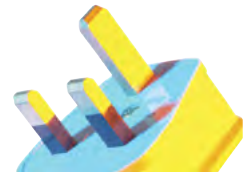


FARM ENERGY

Electric savings: understanding demand and 3-phase motor use



Did you know that sometimes a simple change in your practices can reduce your energy use and save money? For instance, the demand charges on your electric bill can be controlled by you. And understanding how 3-phase motors fit into your on-farm distribution can help you work with your utility to avoid supply problems.



What is electrical demand?

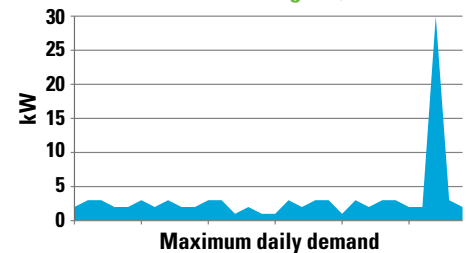
Because of greater electrical load, some electric customers are on an “electrical demand” rate. Many people have trouble understanding this concept. With this rate, customers are charged not only for the amount of energy they use, measured in kilowatt-hours (kWh), but also the maximum amount of electrical energy they are using at any given time, measured in kilowatts (kW). This rate is essentially a charge for having the capability of drawing a greater electrical load. You could think of “demand” as the size of a garden hose. The more water (or kilowatts) you need at any given moment, the larger the hose (transformer, wires, etc) needs to be. It’s like filling a 500 gallon sprayer tank with a ½ inch hose versus a 2 inch hose.

Utilities charge larger customers for demand because they are obligated to furnish adequate electricity for foreseeable demand that customers require. Even though electrical demand may be sporadic throughout a time period (e.g., summer residential air conditioning use or fall grain drying) the utility must have capacity to meet these demands. The cost for providing electricity is determined by both energy used (kWh) and infrastructure (i.e., generation and distribution) that must be present to meet your energy demand (kW). Energy and demand costs are lumped together for smaller users, but demand charges for larger businesses, including some farms, are charged separately. Users subject to demand charges can manage and lessen electric costs by knowing how these charges are assessed.

As an example, a farmer decides that he/she wants to test three aeration fans on grain bins so he/she turns them all on at once. This occurs 2 days before the meter is read for the month of August. After letting them run for 20 minutes, they are all turned off. This action sets the demand charge for the entire month. In this instance, the maximum demand for the month was 30 kW (approx 3-10hp motors). The rest of the farm uses 1500 kWh during that month. If the demand charge is \$10 per kW, this means that there would be an additional charge of \$300 for the demand. During the time the fans were tested, only 10 kWh of electricity was used resulting in a kWh charge of \$1 (10 cents per kWh). The demand charge could be reduced to \$100 if one fan was tested at a time (reducing the demand to 10 kW). If the testing had occurred in the same monthly billing cycle when fans were used for drying, no charge would be levied during the prior month (August) for fan use.

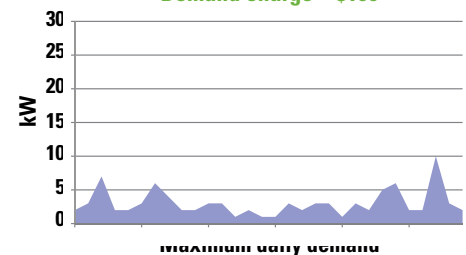
Testing all 3 fans at the same time
Peak Demand = 30kW

Demand charge = \$300



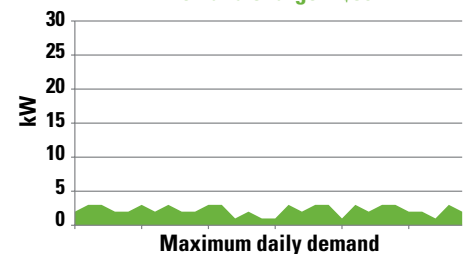
Testing 1 fan at a time
Peak Demand = 10kW

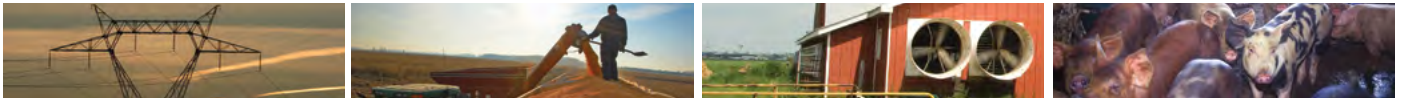
Demand charge = \$100



Fans not tested
Peak Demand = 3kW

Demand charge = \$30





Using 3-phase electrical motors

Single-phase electric motors have a practical upper power limit of approximately 10 horse-power (hp). This limit does not apply to 3-phase motors. Even in smaller sizes 3-phase electric motors ranging from 1 to 10 hp may cost less than single-phase motors of comparable size (although the need for phase conversion on single-phase lines adds to costs). Motors larger than 10 hp often are necessary for grain drying fans or on feed grinding equipment.

Only a small number of farms have 3-phase power available. Supplying 3-phase power is costly due to increased transformer distribution costs that cannot be adequately

amortized with limited seasonal power usage such as fall grain drying or summer ventilation fans in livestock buildings. It's often cost prohibitive to install 3-phase service to the farm. In these cases phase-conversion devices are used.

Even in smaller motor sizes (e.g., 1 – 2 hp) it may be less costly to use the combination of a 3-phase motor and device to convert single- to 3-phase power. Although rotary and static converters have been used, recent developments in electronics have resulted in variable-frequency drive devices being used to both convert single- to 3-phase power and also to allow a much wider range of electrical motor speeds. Motors are ordinarily limited to shaft speeds of 3600, 1800, or 1200 rpm with power supplied at 60 Hz (cycles per

second), however a variable frequency drive takes away this requirement of fixed speed. Variable frequency drives are attractive for use on larger hp motors because of the need for phase conversion. Use on lower hp ventilation fans currently is limited by cost, but may change if costs are driven down further.

Because of significantly increased power needed to be supplied and also the addition of phase converters your electrical power supplier should be consulted when adding significant electric motor loads on equipment such as drying fans or feed processors. Power quality on the distribution line can be affected by phase converters and the power supplier may restrict use of certain types to avoid line problems.

Let's test your electrical energy knowledge.

QUIZ

1. True or False

Farmers can control their monthly electrical demand charges in an effort to reduce their overall energy use and costs.

2. True or False

When choosing a new electric motor, there is little difference between installing a single-phase versus a 3-phase motor.



Photo courtesy of Sukup Manufacturing Co.

No endorsement of products or firms is intended, nor is criticism implied of those not mentioned.

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1. ANSWER: True
2. ANSWER: False