Improved Load Factor = Reduced Power Costs

DAVID L. DIVINE and JIMMY W. CULP
Southwestern Public Service Company

The purpose of this paper is to explain what load factor is, show how it will affect the power bill, and provide a few ideas on how to improve the load factor.

Also, rates will be discussed briefly. The rates used here are Southwestern Public Service Company's rates; however, the principles will apply to most other power companies. Available rates and a basis for selecting the most favorable rate will be provided.

The size of a customer's load has very little effect on his load factor. Load factor is the ratio KW demand and time to KWH consumed. Another definition of load factor is, the amount of time in percentage required by customer demand to reach the KWH consumed. As an example, consider a demand of 1000 KW, a 30-day month, and a consumption of 576,000 KWH. The maximum KWH would be 1000 KW times 720 hours or 720,000 KWH. Dividing 576,000 by 720,000 gives an 80 percent load factor. It should be noted that KW is the rate at which energy is consumed, and KWH is the total energy consumed.

The set of curves in Fig. 1 shows the average KWH cost for four load factors on the large general service rate, and the three steps of the oilfield pumping rate.

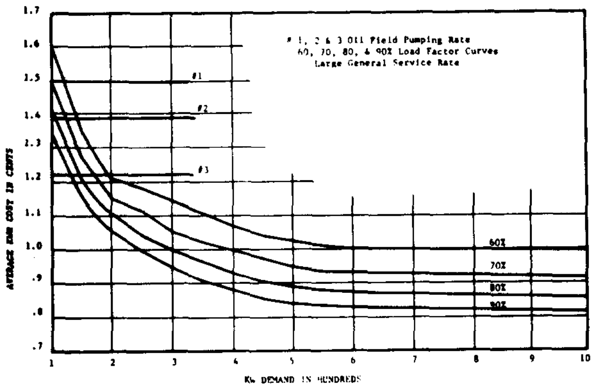

FIGURE 1

The three horizontal lines on the left represent the oilfield pumping rate. Number 1 is for 1 to 10 wells at 1.495¢ per KWH, number 2 is for 11 to 50 wells at 1.385¢ per KWH and number 3 is for 51 or more wells at 1.22¢ per KWH. The number of wells are all the wells in an oilfield and billed on a master account.

Southwestern Public Service Company builds to the lease line on this rate and the customer installs his facilities, such as primary, secondary and transformers from that point. There can be any number of meters on this rate. We normally meter on the secondary side of the customer's transformer banks. Some accounts are metered on this rate with primary meters in cases where the customer has several banks on one primary tap.

The point at which the customer can justify changing from the oilfield pumping rate to the large general service depends mainly on two factors, the number of wells in the field which sets the KWH cost and the amount of investment necessary to tie the leases together for a single metering point. The point to start checking is when the meter or meters on one primary tap reaches 50,000-70,000 KWH. Another point to consider is the minimum on the two rates. The oilfield pumping rate is $1.00 per connected HP. The minimum on the large general service is the demand charge, but not less than $370.00.

The large general service rate and the waterflood rate are basically the same with the waterflood rate being about two percent lower after reaching about 500 KW. The large general service rate will be used in this paper.

The basics of the large general service rate are as follows:

DEMAND CHARGE: $370.00 for the first 200 KW or less of demand per month plus $1.25 per KW for all additional KW of demand per month.

ENERGY CHARGE: 0.80¢ per KWH for the first 230 KWH used per month per KW of demand, or the first 120,000 KWH used per month, whichever is greater. 0.55¢ per KWH for the next 230 KWH used per month per KW of demand. 0.45¢ per KWH for all additional KWH used per month.

DETERMINATION OF DEMAND: The KW determined from the company's demand meter for the 30-min period of the customer's greatest KW use during the month.

PRIMARY SERVICE DISCOUNT: A discount of three percent will be allowed when service is supplied at a line voltage of 13 KV or greater.

This rate includes a power factor adjustment which will not be discussed in this paper. For those who are interested in Power Factor Correction, Southwestern Public Service presented a paper on power factor at the Southwestern Petroleum Short Course in 1970, (see page 169 of the 1970 proceedings).

Also included is a fuel cost adjustment, based on 18.5¢ fuel. This will increase or decrease the net KWH charge 6.5¢ per thousand KWH per 0.5¢ increase or decrease in the cost of fuel delivered at our plants. The following illustration and the curves in Fig. 1 were based on 20.5¢ fuel. This is also applicable to the oilfield pumping rate.

There are some fixed costs in any business. In the electric power business it is primarily generation, transmission, transformation, distribution and metering costs. These costs can be plotted on cost curves with the unit cost being high at the beginning and falling off rapidly to reflect the operational cost at the end. An equitable rate follows approximately the same curve.

Examine the 60 percent curve in Fig. 1. This curve begins at 1.62¢ average at 100 KW and goes to 0.99¢ at 1000 KW. This load factor will never reach the 0.45¢ step; it takes 64 percent or better to reach this step.

The 90 percent curve begins at 1.35¢ average at 100 KW and reaches 0.82¢ at 1000 KW. This is approximately 17 percent lower than the 60 percent curve all the way across.

To illustrate, refer to Fig. 2. This is a quarter of a thermal demand chart which reads from zero to 1.5. The multiplier is determined by the ratios of the current and potential transformers. In this case use a multiplier of 1000.

The billing demand is the peak set in any 30-min period of the month. In Fig. 2 the peak is 1.0. This gives a demand of 1000 KW.

The KWH meter reads 576, the previous reading is 0. 576-0 times 1000 gives us 576,000 KWH. The KWH meter is a dial meter and the previous reading subtracted from the present reading and the difference multiplied by the multiplier will give the KWH used. The previous reading for next month will be 576.

Assuming a 90 percent power factor, there will be no adjustment either way. The power factor is determined by the reading on the KVAR demand meter.

We now have a demand of 1000 KW and a consumption of 576,000 KWH. When the large general service rate is applied to these figures, the result is a total bill of $4996.85.

Determine the load factor by dividing the KWH by the maximum KWH possible on the peak demand. A 1000-KW demand times 720 hours (30-day month) gives 720,000 KWH. Divide the actual KWH 576,000 by 720,000, which gives an 80 percent load factor.

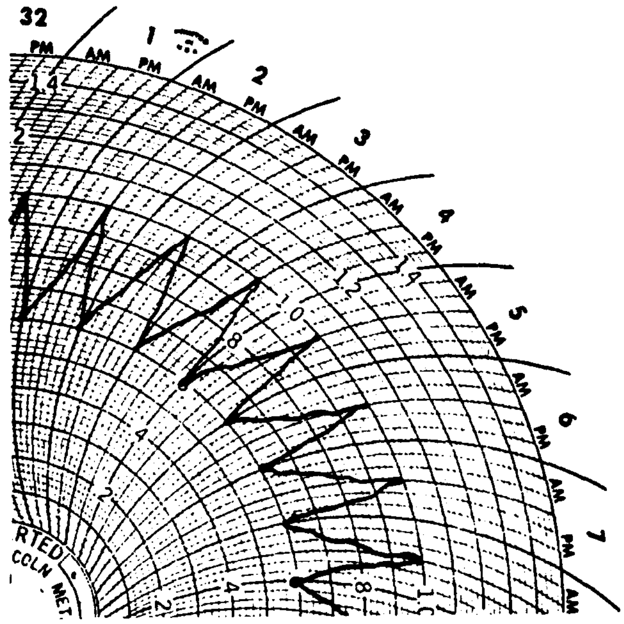

FIGURE 2

Now consider Fig. 3. This is the same load with the peaks reduced drastically. The peak on this chart is .89. This times 1000 gives a 890 KW demand; a reduction of 110 KW. This is a load factor of 90 percent.

The KWH meter reads the same as before: 576,000 KWH. Continue to use the assumed 90 percent power factor. This gives an 890-KW demand and 576,000 KWH. The bill on this would be $4,753.04.

The savings on this is $4,996.85 - $4,753.04 equals a savings of $243.81. This amounts to approximately $2.22 per KW that the demand is reduced. This is a 4.88 percent reduction in cost for a 10 percent increase in the load factor.

Now, compare the 60 percent to the 90 percent load factor! The KWH remains 576,000. The demand for a 60 percent load factor is

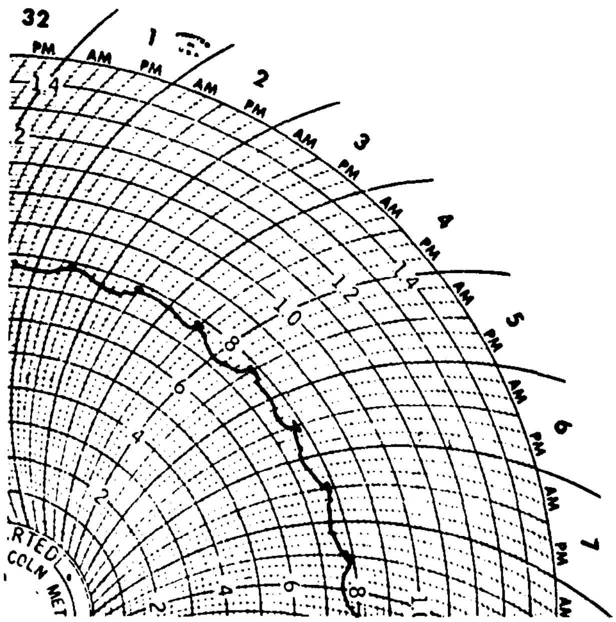

FIGURE 3

1333 KW. The bill for this is $5,698.87 less $4,753.04 for a savings of $945.83.

Most customer load factors run between 75 and 85 percent. It is not unusual for the customer to raise his load factor by 10 percent. Some customers run around 95 percent load factor.

The place to start on load factor correction is locating the periodic loads. Some of these can't be changed. Most salt-water disposals fall in this category, since they are controlled by fluid levels. When designing the disposal system, one might consider a smaller pump with a longer running time and less of a demand.

The use of percentage timers with periods less than 30 min can help. Scheduling any load that is not critical will help. The most common cause of peaks, apparently, is stripper wells that are on time clocks. These should be staggered over the 24-hr period if possible.

The customer will best be able to know the things that can be done to improve his load factor without interfering with production.

Another area in which a good load factor helps is with system losses. System losses vary with the square of the current and any reduction in current takes it off the top of the losses. This also reduces the loading on the facilities, and in some cases could prevent overloading. "System loss" is another good place to look at reducing power costs. The smaller conductor is quite often more expensive in the long run. Most power companies have qualified men who will be glad to help study your system, if desired.

A good load factor will reduce power cost, reduce system losses, reduce loading on facilities and improve voltage.