Economical Operation of Electrified Leases

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The application of electricity for oil field power is becoming more prevalent each day. It is used by rod pump wells, triplex pumps for hydraulic pumping, circulating pumps, automatic lease control systems and various other equipment. It is the purpose of this paper to discuss certain factors affecting the economical use of electric power by rod and hydraulic pump wells.

Most electric utility companies make a kilowatt demand charge in addition to the usual kilowatt hour charge. This kilowatt demand charge is made because the power company must maintain generating equipment of sufficient capacity to supply power equal to the greatest instantaneous demand by the consumers. If this extra power capacity were not instantaneously available, then serious voltage fluctuations would occur during the starting of motors and other sudden increases in power use. The kilowatt demand charge is made on the highest kilowatt consumption recorded on the meter during the month. This figure represents the peak load applied to the power system during the month as determined by the particular type of demand meter in use. A kilowatt hour is one kilowatt of power used for one hour.

Several methods are used by power companies in calculating the power bill and a typical example follows.

kwd x 165 hrs. x $0.02 = demand charge
(kwh - (kwdx165) x $0.008 = kwh charge

For most economical operation the kilowatt demand should be kept at a minimum so that as much power as possible can be billed at the rate of $0.008 per kwh. The misapplication of electric power will not long go unnoticed as it will be instantly reflected by the power bill.

Reduction of Kilowatt Demand

The rod pump well is without a doubt the worst offender when economics are considered. Conditions that result in excess kilowatt demand are: unbalanced pump units, excessive pump and rod size, excessive pumping time, wells on lease all pumping at once instead of being staggered or cycled, stuffing boxes too tight, separator pressure higher than absolutely necessary and paraffin in flow lines. Of the conditions listed above the lease with all wells pumping at once when production is obtained in less than twenty-four hours is the most common and the easiest to correct. Also, it is the largest dollar waster. Pumping times should be arranged so that the kilowatt demand is kept at a minimum.

Take the example of four wells pumping 6 hours each day, each well with an 8 kw load, and all wells pumping at the same time.

Kilowatt demand = 4x8 = 32
Kilowatt hrs./ month = 32x6x30 = 5760
KW demand charge = 32 (165) ($0.02) = $105.60
KWH charge = (5760 - 32 (165)) x $0.008 = $3.84
Total power charge = $105.60 + $3.84 = $109.44

Now take the same wells and stagger the pumping time so that only one well is pumping at a time.

Kilowatt demand = 8
Kilowatt hrs./month = 8x24x30 = 5760
KW demand charge = 8 (165) ($0.02) = $26.40
KWH charge = (5760 - 8 (165)) ($0.008 = $35.52
Total power charge = $26.40 + $35.52 = $61.92

This example illustrates how money can be saved by pumping as few wells as possible at one time.

Wells operating in a continuously unbalanced condition waste power by creating a higher kilowatt load than necessary. The pumping unit can be easily checked for balance by use of a simple hand-held clamp-type ammeter and observing the up stroke amperage and the down stroke amperage. This method is much faster and simpler than a dynamometer and gives good results. Also, the ammeter method balances at the point where electric power is consumed and consequently paid for.

Polish rod stuffing boxes should be kept in good repair and tightened just enough to prevent leakage. It is possible to increase the well load by as much as a kilowatt or more by excessively tight stuffing boxes.

Problems encountered on hydraulic leases (electrified Triplex units) are not too different from those on the rod pump lease. Dollar wasting items are: Pumping all wells at once when not required to get production, excessive pump pressures, improper sized plungers on Triplex, surfacing free type pumps too fast, running paraffin plugs, and excessive paraffin build-up in lines.

Let's examine an actual case where hydraulic equipment was used improperly. The lease is in Ector County, 8 wells producing from the Grayburg at 4100 feet using one Triplex pump with a 40 HP electric motor. The power bill had averaged $141 per month with a kw demand of 36.74. The operating pressure ranged from 1200 to 1500 psig, which was within reason but 1750 psig was used twice a week to run paraffin plugs in 4 wells simultaneously. Also, pressures of 2000 psig and higher were used to surface the two free type pumps and to raise the conventional type pumps in the hydrualic lifts. This momentary use of high pressure for running plugs and unseating pumps resulted in peak demands and the high power bills. Tests were made on the lease which showed that all operations, pumping, running plugs, and surfacing pumps, could be accomplished at a maximum pressure of 1500 psig. The net result was a power saving of $33 per month.

Test Results

A. Original lease operating conditions

	Max. psig	KW Demand
Normal operation - pumping	1500	26.4
Running paraffin plugs in 4 wells at same time	1750	32.0
Lifting pumps	2000	36.0

B. Test conditions to determine minimum operating KW

	Max. psig	KW Demand
Normal operation - pumping 5 wells at same time	1500	26.4
Pumping 4 wells	1250	22.0
Running plugs in one well while pumping 4 other wells	1500	26.4
Running plugs in two wells while pumping 3 other wells	1500	26.4

Pumps could be raised in hydraulic lift instantaneously at 2000 psig.

Pumps could be raised in 5 minutes at 1500 psig.

All of the above data show that the lease can be operated under normal conditions at a maximum pressure of 1500 pisg or 26.4 kw demand.

Power oil which is pressured up and then not needed and by-passed back into the power oil tank is a direct waste of energy and money. The plunger size and the unit sheave size should be selected so that the operation can be carried out with a minimum by-pass oil.

Reduction of Kilowatt Hours

Reduction of kilowatt hours is made by reducing pumping hours. Many rod pump wells are pumped a large portion of the time in a "pumped off" condition. Pumping the well after this condition has been reached results in waste of electrical power and money. Production tests and dynamometer tests should be made to determine the best producing schedule. It is true that many wells require pumping throughout a 24 hour period to obtain the allowable or maximum production. However, in many cases it is not necessary to pump these wells the full 24 hours; they can be cycled by using the time clock in the motor control panel. Pump the well until fluid pound occurs, shut the well in until it fills up again. Then pump the well off. An example might be something like this: Pump two hours, shut in six hours, and so on throughout the day. Also, by using this method it becomes easier in some cases to stagger a greater number of wells and realize a reduction in kilowatt demand.

For hydraulic pumping operations the same well conditions exist but they are not quite as easy to correct. That is, cycling cannot be accomplished automatically as with the rod pump. Seldom are more than six wells pumped by one Triplex and motor. In such an arrangement, several schedules could be worked out; one schedule might be something like this: Pump three wells during time pumper is available, then just before leaving the area in the afternoon, shut in the first three wells and start the other three and use the time clock to shut in the whole unit if desired after sufficient pumping time.

Electric Power Saved by a West Texas Operator

The district operated some twelve electrified leases all producing from the Grayburg at about 4100 feet. These leases consisted of approximately 52 rod pumps and 15 hydraulic pumps (Three Triplex pumps). The motors on the rod pumps ranged from 7 1/2 HP to 15 HP and the three Triplex motors were 40 HP units. One lease had 27 wells while another had just 1 well. Just about all possible conditions existed regarding sizes, numbers, and producing characteristics. An investigation was made on these leases as outlined in this paper. After certain changes in operating procedure were made, the district power cost was reduced by $415.63 per month or 25%.

It is interesting to note that this saving was made by just changing operating procedures. Since lease operating personnel have the most direct control over lease operating procedures used, they exert the greatest influence upon the day-to-day economies of electrified leases.