Effects of Electric Rates on Power Expenses of Cotton Gins

Arkansas - Oklahoma - Texas

by John D. Campbell

Farmer Cooperative Service
U.S. Department of Agriculture

Marketing Research Report 470
July 1961

FARMER COOPERATIVE SERVICE
U. S. DEPARTMENT OF AGRICULTURE
WASHINGTON 25, D. C.

Joseph G. Knapp, Administrator

The Farmer Cooperative Service conducts research studies and service activities of assistance to farmers in connection with cooperatives engaged in marketing farm products, purchasing farm supplies, and supplying business services. The work of the Service relates to problems of management, organization, policies, merchandising, product quality, costs, efficiency, financing, and membership.

The Service publishes the results of such studies, confers and advises with officials of farmer cooperatives; and works with educational agencies, cooperatives, and others in the dissemination of information relating to cooperative principles and practices.

This study was conducted under authority of the Agricultural Marketing Act of 1946 (RMA, Title II).

Contents

	Page
Findings	iii
Purpose and scope	2
Electric power charges under 32 rate schedules	3
Electric power measurements	3
Units of measurement	5
Reading electric meters	6
Data used in figuring power bills, model gin	7
Electric rate schedules for cotton gins	9
Flat rates	9
Sliding scale energy rates	9
Combined demand charge and energy rates	10
Minimum bills	11
Adjustments and sales taxes	12
Relation of demand charges, minimum bills, and peak loads to costs	13
Appendix	15

Findings

Some cotton gins pay more than twice as much as others for the same amount of electric power. This was one of the findings in a study of power expenses at 32 gins in Arkansas, Oklahoma, and Texas in 1959-60.

This report of the study shows the effects of rate schedules on the cost of electricity and explains how power companies measure electricity and the terms they use. It will be helpful to all ginners interested in keeping their power expenses as low as possible.

Comparisons for this report were based on charges for 90,000 kilowatt hours used over a 5-month period in ginning 2,000 bales in a typical gin plant equipped with electric motors totaling 350 horsepower.

Costs to gins under these conditions ranged from $0.65 to $1.85 a bale and averaged $1.36. This difference of $1.20 a bale between the highest and lowest charges would amount to $2,391 in a 5-month season.

While this maximum difference of $1.20 a bale was between rates in two separate areas, large variations also existed within most areas. In eastern Arkansas, there was a difference of $0.95 a bale or $1,901 a season in the charges for 90,000 kilowatt-hours; in southwest Oklahoma, a difference of $0.66 a bale or $1,328 for the season. Differences within the Texas areas ranged from $0.34 to $1.16 a bale, or from $664 to $2,305 a season.

The 32 rate schedules studied had but one factor in common, kilowatt-hours, and even they were not handled the same way in all schedules. Some factors and procedures varied slightly; others widely. However, there was enough similarity in the schedules to permit their classification for discussion into three groups: (1) Flat rates; (2) sliding scale rates; and (3) combined demand charges and energy rates.

The group into which a rate schedule falls in this classification does not indicate whether electric bills under it will be high or low. Energy rates, sizes of blocks of energy at the various rates, levels of minimum bills, and levels of demand charges, if any, largely determine what a gin pays for a given amount of electric power.

Because of their numerous variations, electric rate schedules may appear to be rather complex. However, it is not difficult to learn to figure electric bills under one or a few schedules. This report explains the general procedure. Gin managers and bookkeepers, once they know how specific rate schedules are used, can check the bills they receive from power companies and can compare charges for any amount of power under different schedules.

A customer's maximum demand, as approximated by horsepower of motors connected or as measured by demand meter records, indicates to the power company the amount of generating and transmission equipment it needs to serve that customer. The fixed costs on that proportionate part of the equipment are a valid basis for establishing a minimum or a demand charge. Whether or not the amount of a particular charge is justified is another matter and beyond the scope of this study.

When seasonal customers, such as cotton gins, require electrical energy during power companies' peak load periods, the cost of serving them is higher than it would be in off-peak periods.

Under most rate schedules applicable to cotton gins, the per-bale cost of electrical energy decreases when larger volumes are ginned. The level of electric rates probably would be lowered by most power companies if gins operated more continuously and for longer seasons.

Effects of Electric Rates on Power Expenses of Cotton Gins

Arkansas - Oklahoma - Texas

by John D. Campbell
Cotton and Oilseeds Branch
Marketing Division

Ginners have a vital interest in electric power rates and schedules because power is one of their major expense items, representing from 5 to 20 percent of the total cost of ginning. The present trend toward installing additional equipment for cleaning and conditioning emphasizes the importance of keeping power expenses as low as possible.

The Houston Bank for Cooperatives found that power expenses of some Texas cooperative gins appeared high in proportion to total ginning expenses and also seemed excessive when compared with those of other cooperative gins. The Bank brought this situation to the attention of Farmer Cooperative Service.

A preliminary survey indicated that gins in several states had similar expense problems. This study was then undertaken, with selected gins in Arkansas, Oklahoma, and Texas providing basic data.

Differences in rate schedules among power companies were found to have a marked effect on ginners' costs in these areas. Charges for the same amount of electricity delivered in the same way varied widely. In some cases, the differences amounted to more than $1 a bale on a 2,000 bale volume.

The proportion of gins using electric power doubled during the period 1940-1956, although their number increased only 178.[1] (In 1940, there were 13,073 gins in operation in the United States and 3,654 used electric power. By 1956, the total number of gins had declined to 6,836, of which 3,832 operated with electricity.) Many ginners will find the data in this report helpful, even though they operate outside the specific areas studied.

---

[1] Figures for 1940 are from "Cotton Ginning Machinery and Equipment in the United States, 1945," Bureau of the Census, U. S. Dept. of Commerce, 1946. Figures for 1956 are from "Cotton Gin Equipment, United States," Agricultural Marketing Service, Cotton Division, U. S. Dept. of Agr., 1957.

Purpose and Scope

The purpose of this study was to help ginners keep power expenses as low as possible.

In gathering data for this study, managers of 53 cotton gins in Arkansas, Oklahoma, and Texas were interviewed personally. Forty-three of the gins were cooperatives. The other 10 belonged to individuals, partnerships, and companies.

Thirty-two of the gins visited used electric power, obtained from 31 power companies. (One power company had two rate schedules for gins surveyed.) Seven of the gins using electric power were in eastern Arkansas, 6 in southwestern Oklahoma, and 19 in the major cotton producing areas of Texas.

Data collected included total number of bales ginned and distribution by months, horsepower of motors used, energy or kilowatt-hours used, demand meter records, electric bills, and electric rate schedules.

As expected, the gins differed widely in volumes ginned, total horsepower of electric motors, energy used per bale, and amounts paid for electric power.

These differences, and others, made direct comparisons of charges for electric power of little or no value. Consequently, a model approach was used to get all factors constant except rate schedules. This procedure permitted a comparison of costs for the same amount of electric power delivered in the same way under the different rate schedules.

Specifically, a gin was assumed to have electric motors totaling 350 horsepower, to have ginned 2,000 bales in 5 months, and to have used 45 kilowatt-hours per bale. Total charges for electricity for the season and average cost per bale were then figured for each of the 32 rate schedules, pointing-up the effect a rate schedule has on such costs.

Electric rate schedules often appear rather complex to those unfamiliar with them. The groupings, discussions and examples in this report may help clarify this problem.

Sometimes gin operators do not understand the basis for demand charges and minimum bills. Their function in electric rates is explained in this report. However, levels and amounts of these charges are neither justified nor criticized. Such evaluations were beyond the scope of this study.

This report shows the cost to gins of the same amount of electricity under different rate schedules in the areas surveyed; explains in general how rate schedules are used in figuring power bills and discusses the relation of cost of electric power to demand charges, minimum bills, and peak-load periods.

Another report, based on the same study, will include costs of internal combustion engine power for cotton gins and a broader coverage of expenses of electric power. Installed costs for electric motors and engines and ranges in horsepower of both electric motors and internal combustion engines will be covered.

Electric Power Charges Under 32 Rate Schedules

Specific provisions of rate schedules are important to gin managers and owners. If a gin has an opportunity to choose between power companies, rate schedules should be compared carefully to determine which company offers the most advantageous rates. Ginners with established sources of power may also find schedule comparisons helpful in evaluating their costs of operation.

Under the 32 rate schedules studied in this report, charges for the same amount of electricity ranged from $0.65 to $1.85 a bale and averaged $1.36 (table 1). The highest expense per bale was almost three times the lowest, and the six highest averaged over twice the average of the six lowest.

Average costs per bale for electricity shown in table 1 are shown in 20-cent groupings in table 2, page 5. Although no single 20-cent group predominates, 8 of the 32 fell within $1.40-$1.59.

Differences between total electric bills for the season (table 1) came to rather large amounts in some cases. The highest bill was $3,700 while the lowest was $1,309, a difference of $2,391. These bills were not from the same area. Sales tax was included, where applicable.

Differences in season costs within areas also were substantial. The highest bill for the season in Arkansas came to $3,700 and the lowest to $1,799, making a difference of $1,901. The highest in Oklahoma was $3,040 and the lowest $1,712, a difference of $1,328.

In Texas, bills in the northwest area differed the most. There, the highest bill for the season was $3,614 and the lowest was $1,309, making a difference of $2,305. In the Blackland area, the variation was least but all bills were higher than the average. The highest bill in that area came to $3,593 and the lowest to $2,929, a difference of $664. In South Texas, the highest season bill amounted to $3,152 and the lowest to $1,876, making a difference of $1,276.

Electric bills for the actual or expected power requirements of a given gin, figured for selected rate schedules, would give more exact expenses than the general comparisons. Other volumes, horsepower of motors, distribution of bales ginned, or amount of energy per bale also would mean substantially different expenses per bale, under some rate schedules, from those shown in table 1. The subsequent report planned for this study will indicate some of those differences.

Electric Power Measurements

The first step in understanding rate schedules is understanding the terms used by power companies.

Therefore, before discussing the data used in figuring electric bills under the 32 rate schedules referred

Table 1.--Total electric expense per 5-month season and average per bale for gin with assumed 350 hp connected load, ginning 2,000 bales and using 45 kwh per bale under 32 rate schedules, Arkansas, Oklahoma and Texas, 1959-60[1]

Area and power firms[2]	Total bills for season	Average expense per bale
Eastern Arkansas:[3]		
Firm A	$3,244	$1.62
" B	3,700	1.85
" C	3,636	1.82
" D	1,799	0.90
" E	2,884	1.44
" F	2,012	1.01
" G	2,257	1.13
Southwest Oklahoma:[4]		
Firm H	2,160	1.08
" I	1,922	0.96
" J	3,040	1.52
" K	1,712	0.86
" L	2,798	1.40
" M	2,754	1.38
South Texas (Rio Grande Valley - Corpus Christi and El Campo areas):		
Firm N	3,152	1.58
" O	2,673	1.34
" P	1,876	0.94
" Q	2,265	1.13
" R	2,698	1.35
Texas Blackland:		
Firm S	3,212	1.61
" T	2,929	1.46
" U	3,593	1.80
Northwest Texas (Abilene-Lubbock areas):		
Firm V	1,845	0.92
" W	2,669	1.33
" X	3,450	1.72
" Y	2,564	1.28
" Z	1,309	0.65
" AA	3,353	1.68
" BB	2,925	1.46
" CC	2,914	1.46
" DD-1[5]	3,614	1.81
" DD-2[5]	3,361	1.68
" EE	3,017	1.51
Average of 32	$2,729	$1.36
Range	$1,309 - 3,700	$0.65 - 1.85

[1] Bills calculated on basis of data from electric rate schedules shown in Appendix.

[2] Each letter or set of letters represents a different power company, city owned plant, or rural electric cooperative association.

[3] Three percent State sales tax was included in bills for Arkansas.

[4] Two percent State sales tax was included in bills for Oklahoma.

[5] Two gins included in survey obtained power from Firm DD but under different rate schedules.

Table 2.--Distribution of costs per bale for electric power under 32 rate schedules, by 20-cent cost grouping [1]

Cost of electricity per bale	Number in each group
$0.60 to $0.79	1
0.80 to 1.00	5
1.00 to 1.19	4
1.20 to 1.39	5
1.40 to 1.59	8
1.60 to 1.79	5
1.80 and over	4

[1] If the expenses per bale in table 1 were from a normal distribution, one-half would have been between $1.15 and $1.57 ($0.21 above and below the average of $1.36 per bale).

to in table 1, we will explain briefly how electricity is measured and meters are read.

Units of Measurement

The most commonly used unit for measuring electric power is kilowatt-hours, generally abbreviated to kwh. A kilowatt-hour is equal to the power used by ten 100-watt light bulbs in 1 hour, or 1,000 watts used for 1 hour. A watt is the rate of work performed by 1 ampere under 1 volt of pressure; watts equal volts times amperes (with a technical adjustment for technical uses). Time in hours multiplied by a constant rate of energy used, or time in hours multiplied by the average of variable rates of energy used, determines total kilowatt-hours.

Maximum demand is the highest rate at which energy is used. It is an important measurement to a power company. Maximum demand of a customer indicates the size and extent of facilities the power company needs to serve that customer.

Ten lighted 100-watt bulbs would use energy at the rate of 1 kilowatt and if lighted for 15 minutes would create a demand of 1 kilowatt (or kw) on a meter measuring 15-minute periods. If a power company uses meters measuring 30-minute periods, 10 100-watt bulbs lighted for 30 minutes would create a demand of 1 kilowatt. If the 10 100-watt bulbs were the maximum rate of use or load of a customer, then 1 kilowatt would be his maximum demand.

Total horsepower of connected electric motors is used by some power companies as an approximation of the maximum demand of cotton gins or other industrial consumers. Other companies use kilowatt demand or kilovolt-ampere (or kva) demand meters to record maximum demands.

Kilowatt demand meters record the maximum average rate of energy used in any 15 or 30 minutes between readings. Kilovolt-ampere demand meters record the maximum average rate energy is delivered in any 15 minutes during a month or other period. A kilowatt-demand meter records the maximum rate at which energy is used in work; a kilovolt-ampere demand meter records energy delivered to a customer, including not only energy used in work but also energy lost and wasted in transformers, motors operating at part of capacity, and from other factors.

Conversion ratios and relationships of horsepower, kilowatts and kilovolt-amperes are needed for comparing charges under some rate schedules. Technically one horsepower equals 745.7 watts or 0.7457 kilowatts. For more general use, one horsepower is often considered equal to 0.746 or 0.75 kilowatts or one kilowatt equals 1.34 horsepower.

If all energy delivered to a customer were used without loss or waste, kilowatt demand and kilovolt-ampere demand would be identical and a power factor of 100 percent would exist. However, losses and wastes do occur and kilowatt demands are frequently between 80 and 90 percent of kilovolt-ampere demands. Therefore a power factor of 85 percent was used for conversions in this report. Kilowatt demands were divided by 0.85 to find corresponding kilovolt-ampere demands.

Reading Electric Meters

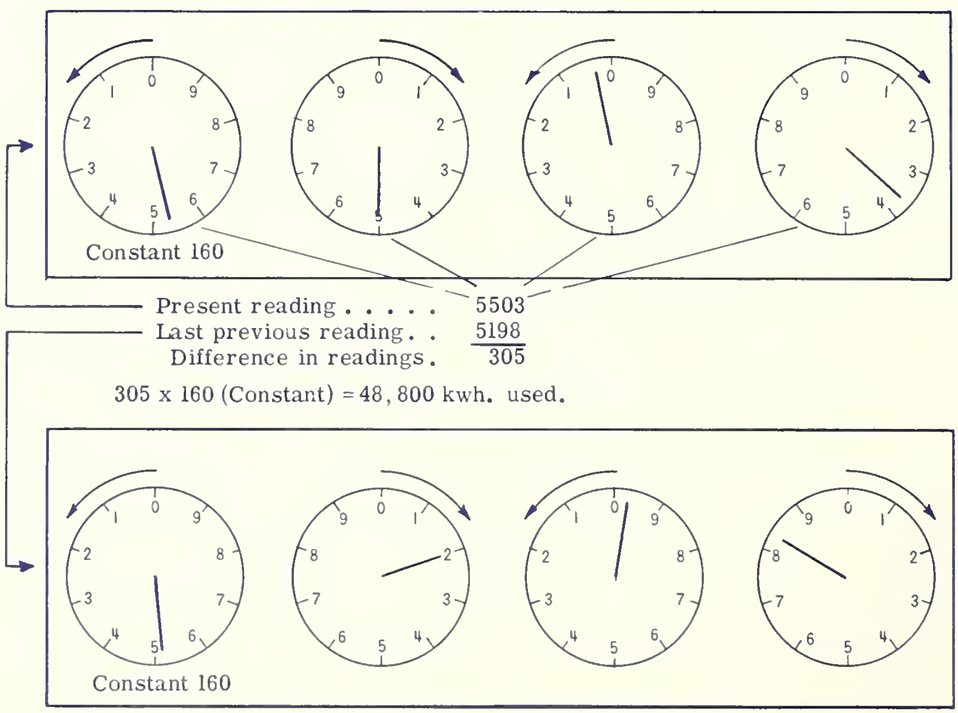
Some kilowatt meters for residences can be read directly, like mileage on an auto speedometer. But most kilowatt meters have dials with hands.

To read a kilowatt meter with dials, start at the left and proceed to the right, setting down a number or a zero for each dial. When a hand or pointer is between two numbers, use the smaller one, as shown in Figure 1 for dial on left. When the hand is exactly on top of a number, use that number if the hand on the next dial to the right is directly on or has passed its zero point. If the hand of the next dial to the right has not reached zero, use the next smaller number below the one the hand is directly over.

The previous kilowatt meter reading is subtracted from the present reading to determine the difference

Figure 1

Examples of Meter Readings and Their Use to Find Kilowatt-Hours.



in meter readings for a month or other period. The difference in readings is then multiplied by the constant applying to that meter to determine the kilowatt-hours used in the period. The constant in figure 1 is 160.

The constant applying to a meter is usually stated on the meter. An electric meter requiring the use of a constant to find kilowatt-hours used might be compared to a clock with only an hour hand, while the time is wanted in minutes. The reading of the hour hand would be multiplied by a constant of 60 to find minutes.

Residence meters usually have a constant of 1; consequently kilowatt-hours used are numerically the same as the difference in meter readings. Meters used at gins may have any one of several constants.

Kilowatt demand meters ordinarily are installed where kilowatt demand is a factor in figuring bills. One type of kilowatt demand meter has a hand that points to the highest reading during any 15 minutes of the period since it was re-set at zero. That reading, say 1.75, is multiplied by some constant, such as 160, to find the kilowatt demand.

Data Used in Figuring Power Bills, Model Gin

The preceding sections explained how power companies measure electric energy and the terms they use. This part of the report and table 3

Table 3.--Data used for figuring electric power bills for model gin under 32 rate schedules in use in Arkansas, Oklahoma, and Texas, 1959-60

Demand factors	Distribution by months					Total
	Highest	2nd Highest	3rd Highest	4th Highest	Lowest	
Total horsepower of motors	350	350	350	350	350	350
Percent of bales ginned	52.0	29.8	13.7	3.5	1.0	100
Number of bales ginned	1,040	596	274	70	20	2,000
Kilowatt-hours used @ 45/bale	46,800	26,820	12,330	3,150	900	90,000
Demand factors other than horsepower of motors:						
Kilowatt demands						
on 15 minute periods [1]	245	245	245	184	123	-
on 30 minute periods [2]	239	239	239	179	120	-
Kilovolt-ampere demand [3]	288	288	288	216	145	-

[1] Calculated at 70 percent of total horsepower of connected motors for three highest months and at 75 and 50 percent of highest month for 4th and lowest months.

[2] Calculated at 97.5 percent of 15 minute kilowatt demand.

[3] Calculated from 15 minute kilowatt demand by dividing it by 0.85.

deal with the specific data we used in figuring power bills for the model gin under the 32 rate schedules shown in table 1.

The electric motors in the model gin were assumed to total 350 horsepower. Percentages used to determine monthly distribution of the 2,000 bales assumed to have been ginned were based on the average of 42 gins in the survey that reported these data.

Although the average volume per gin is increasing, the 2,000-bale volume was selected because over 60 percent of all gins processed less than 2,000 bales in 1956-57. It is in these relatively low volumes that the cost of electricity per bale becomes critical under some rate schedules.

Some gins completed their active season in 2 to 4 months but others ginned cotton for 8 months. However, since managers reported ginning 99.5 percent of bales in 5 months, the bales ginned at the 42 gins in their 5 most active months were used to find percentages in table 3.

The 45 kilowatt-hours assumed to have been used per bale appeared representative for electric motors totaling 350 horsepower, according to data collected in the survey. The energy actually used by gins varied for several reasons and had a range of over 20 kilowatt-hours per bale at gins with about the same motor horsepower.

For the 3 most active months, kilowatt demand for 15-minute meter periods was assumed to be 70 percent of horsepower of electric motors used. If all gin motors had been fully loaded for a 15-minute period, the kilowatt demand would have been approximately 75 percent of horsepower of electric motors. However, gin motors are rarely all fully loaded for 15-minute periods and survey data indicated 70 percent of horsepower was closer to usual readings than 75 percent.

Kilowatt demand for the fourth month was estimated to be 75 percent of that in the 3 most active months. For the fifth or least active month, the kilowatt demand was estimated at 50 percent of that for the 3 most active months. Both of these estimates were based on limited data from the survey.

Kilowatt demand for 30-minute meter periods was estimated as 97.5 percent of the kilowatt demand for 15-minute periods. This procedure was based on experience reported by Rural Electrification Administration.[2]

Kilowatt demand was reported in the survey to range from 0.80 to 0.90 of kilovolt-ampere demand. Kilovolt-ampere demand in table 3 was determined by dividing the 15-minute kilowatt demand by 0.85.

Under actual operating conditions, the average kilowatt-hour used per bale and the kilowatt demand or kilovolt-ampere demand often differ between most active months. However, the assumptions used were made to establish fixed amounts of power for use in comparing electric bills and they seemed satisfactory for that purpose.

---

[2] Large Power Rates, an Explanation for Laymen, Rural Electrification Administration, Management Division, U. S. Dept. of Agr., June 1948.

Electric Rate Schedules for Cotton Gins

Some electric power companies have special rate schedules that apply only to cotton gins. Other companies use general industrial or large power rate schedules for gins.

Rate schedules for the cotton gins studied differed in both major and minor factors used for figuring charges. The only factor common to all 32 schedules was kilowatt-hours used and they were handled in several different ways.

In spite of the numerous differences in the rate schedules, there were enough similarities to permit their classification into three groupings:

1. Flat rate schedules

2. Sliding scale energy rate schedules

3. Combined demand charge and energy rate schedules

The term "groupings" was chosen to avoid confusion with technical classifications by types. Groupings were based on the general way charges were made on energy and demand.

Flat Rates

Under a strictly flat rate schedule, the same rate is charged for each kilowatt-hour regardless of how few or how many are used. Fixed costs of power companies are thus spread among all customers in proportion to energy used. For example, a power company may charge gins 3.0 cents per kilowatt-hour for energy used and that is the only charge made.

Bills for electric power are very easy to figure under strictly flat rates. For example, table 3 shows 46,800 kilowatt-hours were used in the highest month. Under a flat rate of 3.0 cents per kwh, the actual rate charged one gin in survey, the calculations would be as follow:

46,800 x 3.0¢ = $1,404

The $1,404 would be the bill for that month unless fuel or other adjustments or a state sales tax applied. (Adjustments are discussed on page 12).

Flat rates are sometimes modified by the addition of minimums for monthly, seasonal, or yearly periods.

Sliding Scale Energy Rates

Under sliding scale rates, a lower rate per kilowatt-hour applies to each successive block of energy. For example, monthly sliding scale rates charged one gin in the survey were:

4.0¢	per	kwh	for first	100	kwh
2.5¢	"	"	" next	900	"
2.0¢	"	"	" "	4,000	"
1.5¢	"	"	" "	15,000	"
1.0¢	"	"	" all additional kwh		

These blocks of 100, 900, 4,000 and 15,000 kilowatt-hours and charges for them of $4.00, $22.50, $80.00, and $225.00 were fixed and the same for all gins covered by that rate schedule, regardless of total horsepower of motors, bales ginned, or other differences.

A gin that pays for its electric power on the basis of a sliding scale can work out a cumulative table of kilowatt-hours and charges to speed the progress of figuring bills or checking statements from the power company. For instance, in the example given at the beginning of this section, the first four blocks total 20,000 kwh. The total charge for these 20,000 kwh, figured at the block rates given in the example, would be $331.50. This figure would apply in any month in which 20,000 or more kilowatt-hours were used.

In table 3, kilowatt-hours used in the highest month totaled 46,800. The cumulative table could be used thus:

46,800 kwh used in month	
First 20,000 kwh (first 4 blocks)	$331.50
Balance 26,800 kwh @ 1.0 cents per kwh	268.00
Total bill	$599.50

It will be noticed that the above bill does not include any fuel or other adjustments or sales taxes.

The size of blocks and the rates charged differ widely among power companies. Some companies have one or more energy blocks fixed in size and one or more varying with such factors as horsepower of connected motors, kilowatt demand, kilovolt-ampere demand, or bales ginned.

When sizes of blocks are determined by connected horsepower, the size of blocks for a given gin are fixed as long as horsepower and rate schedule remain unchanged. When sizes of blocks are determined by variables, as by kilowatt demand, such variables have to be determined first before power bills can be figured for any period. This requires additional calculations but they are simple when the procedure is understood.

An example of calculating charges on variable size blocks is shown in the second example in the next group of rates.

Combined Demand Charge and Energy Rates

Rate schedules in this group have one charge based on a demand factor and another charge on kilowatt-hours. These, added together, give monthly, seasonal, and yearly bills. Demand charges are mostly on horsepower of motors connected or on kilowatt demand for 15-minute meter readings. A few companies figure these charges on 30-minute kilowatt demand meter readings and a few use kilovolt-ampere demand meter records.

Demand charges may apply every month of the year, only to months when motors are connected, part of months in a season, or to the season or year. Some demand charges include specified amounts of energy. In such schedules, charges are made only on energy used in excess of that included in the demand charges.

Energy charges in combined rate schedules may be on a flat rate or sliding scale. Sliding scale rates may be on either fixed blocks or on blocks that vary with a demand factor.

One gin in the survey paid for electric power on the basis of this simple combined demand and energy rate schedule with a flat energy rate.

Demand charge (for season):

$7.00 per horsepower of motors connected (Billed monthly for first 5 months at $1.40 per horsepower).

Energy rate (monthly):

1.2¢ per kwh used.

Calculations for the highest month in table 3 under the above rates would be as follow:

350 horsepower @ $1.40	=	$490.00
46,800 kwh used @ 1.2¢	=	561.60
Total bill for month (not including sales tax)	=	$1,051.60

Demand charges and energy rates on a sliding scale are combined in the following examples from a rate schedule applying to another gin included in the survey.

Demand charges (monthly):

$0.75 per kilowatt (kw) of billing demand (Kw demand determined by kilowatt meter for 15-minute periods)

Energy rates (monthly):

2.0¢ per kwh for first 50 kwh per kw of demand
1.5¢ " " " next 100 " " " " "
0.8¢ " " " all additional kwh used in month

Calculations of a bill under this schedule for the highest month in table 3 would be:

Demand charges:

245 kw demand = 245 x $0.75	=	$183.75

Energy charges:

(1) Energy used was 46,800 kwh		
(2) 2.0¢ block = 50 x 245 = 12,250 kwh @ 2	=	245.00
(3) Balance (1)-(2) = 34,550 kwh		
(4) 1.5¢ block = 100 x 245 = 24,500 kwh @ 1.5¢	=	367.50
(5) Remainder (3)-(4) = 10,050 kwh @ 0.8¢	=	80.40
Total bill for month		$876.65

This bill, like the other examples, does not include any adjustments or State sales taxes.

The examples for the different groups of rate schedules do not represent levels of electric bills to expect from any group. Demand charges, energy rates, and minimum bills and the sizes of blocks at various rates largely determine amounts of electric bills rather than the group in which a rate schedule would be placed.

It is not likely that a monthly minimum charge would apply to 46,800 kilowatt-hours, as used in the examples, under any rate schedule on gins. However, minimum bills, adjustments, and sales taxes often change power bills by considerable amounts, so they will be discussed briefly.

Minimum Bills

Some rate schedules include provisions for minimum bills or charges. These are the lowest amounts power companies charge per month, season or year. They apply when the charges, as calculated for energy or for energy and demand, total less than the minimum charges provided for in the rate schedules. When minimums apply, they replace the bills calculated for energy and sometimes for energy and demand. Minimums are applied to gins when the amount of energy used is small in relation to horsepower of connected motors.

Minimums may be included in schedules in any rate group. They are calculated in several ways but in most cases are easy to understand and figure. How minimums are calculated and when they apply are stated specifically in rate schedules that include them and are usually identified, on statements of power companies.

Minimum charges sometimes seem too high to owners of small volume gins for the energy they use. However, they are supposed to cover overhead cost on generating and transmission equipment as well as cost of energy used and some power companies consider them more equitable. Whether a given minimum charge is reasonable or not is beyond the scope of this report. Gin owners with small volumes may need to investigate costs of other types of power, or their actual problem may be the small volume of bales ginned.

Adjustments and Sales Taxes

Many electric rate schedules have fuel and tax adjustment clauses. Sometimes other kinds of adjustments are included, such as a reduction in bills for the use of more than the specified amount of energy per horsepower or per kilowatt of demand. Some companies give discounts for prompt payment; other companies add a penalty if bills are not paid promptly.

Fuel adjustment clauses generally provide for specified increases or decreases in charges per kilowatt-hour to correspond with increases or decreases in prices of fuel used to generate energy. Such adjustments may fluctuate from month to month or be constant for several months. In any case where fuel adjustments are applied, they must be used to figure the bills for power as the companies figure them.

Tax adjustment clauses provide for allocating increases in certain taxes among customers. Such adjustments may be applied as a percentage of power bills or in some other way such as on the basis of kilowatt-hours used. Tax adjustments, like fuel adjustments, are not always applied even though clauses providing for such adjustments are included in rate schedules.

In some States, sales taxes are collected by electric companies on customers' bills. In table 1, sales taxes were included in figuring bills for Arkansas and Oklahoma. Rates were 3 percent in Arkansas and 2 percent in Oklahoma in 1959-60. Texas did not have a State sales tax in 1959-60.

Relation of Demand Charges, Minimum Bills, and Peak Loads to Costs

Costs of furnishing electric power to customers can be divided into two major sources. One of these is the fixed cost of generating and transmitting equipment. The other is the variable cost of generating and delivering energy or kilowatt-hours.

Fixed costs include interest on investments, depreciation, taxes, and similar items that are the same regardless of the proportion of generating capacity used.

Fixed costs have to be covered. They are often collected, in effect, by setting considerably higher energy rates on the first few blocks of energy in rate schedules. Rate schedules in which a demand factor sets the size of one or more blocks charge part of the fixed costs on those blocks.

Flat electric rates allocate fixed costs in proportion to energy used rather than in proportion to costs to the power company for serving the different consumers. In setting the amount of minimum bills, power companies include sums applicable to fixed costs.

Some power companies allocate fixed costs more or less proportionately among large customers, such as gins, by including demand charges in rate schedules. However, demand charges are often omitted, as such, from residence and some other rates because customers object to them. They do not realize or understand that the power company has fixed costs in serving them that are different from costs of kilowatt hours.

Variable costs of generating and delivering energy are made up largely of fuel expense and tend to be close to the same amount per kilowatt hour, regardless of the number of kilowatt hours used by individual customers. These costs are less than half the total cost of serving some customers, especially those using small amounts of energy.

While valid reasons exist for establishing demand charges and having minimum bills, a power company's use of either, neither, or both does not indicate that the rate schedule is either reasonable or unreasonable.

An important factor in the cost of furnishing power for a given purpose or to a particular large customer, such as a gin, is the time such requirements occur. Suppose, for example, that customers "A" and "B" each require electric power equal to 5 percent of the generating capacity of Company X, but for only 3 months of the year. Suppose that "A" requires power when Company X's year-round customers are taking all the energy the Company has capacity to produce and deliver. To supply power to "A", Company X will either have to install additional generating and transmitting equipment or buy power from another power company.

On the other hand, suppose that customer "B" requires electric power in a 3-month period in which year-round customers are using only 80 percent of the energy that Company X has capacity to generate and deliver. Under these circumstances, Company X can obviously furnish power to customer "B" at lower cost than to "A".

Power companies have peak-load periods during days as well as months or seasons. These peak-load periods change with new developments, such as increased use of air conditioners, irrigation pumps, or other changes in power requirements.

Some electric power companies include provisions in gin rate schedules or contracts that require gins to stop operating for short periods during days or nights, upon request of the power company. This is to help the power companies handle peak-load periods. Since such a limitation would permit the power company to handle peak loads at lower cost, the gin should be granted a lower rate.

Appendix

Data from electric rate schedules used in figuring electrical expenses in table 1 are given here.

Rates listed in Federal Power Commission (FPC) rate books are shown for most firms. Numbers in parentheses after letters "FPC" correspond to numbers used by the FPC in National Electric Rate Books issued during 1960.[1] Dates shown are effective dates of schedules.

EASTERN ARKANSAS

Firm A: FPC (8) Ark., Aug. 25, 1955, p. 1

Energy rate: (Monthly)

$4.50	for first 56 kwh or less	
6.0¢	per kwh next	94 kwh
4.0¢	" " "	350 kwh
3.0¢	" " "	3500 kwh
2.5¢	" "	all additional kwh

Minimum monthly bill: $4.50 for first 6 hp or less, plus $0.75 for each additional hp or fraction thereof of connected load.

Minimum seasonal bill: $9.00 per horsepower or fraction thereof.

Fuel adjustments: Applied in 1959-60.

Firm B: FPC (21) Ark., May 16, 1957, p. 3

Energy rate: (Season)

4.2¢	per kwh for	first 1,000 bales per season
3.7¢	" " "	next 1,000 bales per season
3.2¢	" " "	all over 2,000 bales per season

Minimum seasonal bill: $6.00 per hp connected.

Seasonal discount: 1% discount for each 50 kwh per hp in excess of 300 kwh per hp per season, not to exceed 15%.

Fuel adjustments: Applied in 1959-60.

---

[1] A National Electric Rate Book is published yearly by the Federal Power Commission for each State. Individual State rate books are available at 25¢ each from Superintendent of Documents, U. S. Government Printing Office, Washington, 25, D. C.

Firm C: Ark. REA 1959-60 rate

Demand charge: (Season)

$7.00 per hp connected

Energy rate:

1.2¢ per kwh used

Minimum seasonal bill: Demand charge.

Firm D: FPC (84) Ark., July 12, 1950, p. 10

Energy rate: (Monthly)

5.00¢ per kwh for first 200 kwh
4.00¢ " " " next 500 kwh
3.00¢ " " " " 1000 kwh
2.00¢ " " " " 1300 kwh
1.75¢ " " " " 2000 kwh
1.50¢ " " " all over 5000 kwh

Minimum bill: (Monthly)
75¢ per hp for first 10 hp of connected load
50¢ " " " each additional hp.

Firm E FPC (96) Ark., July 1, 1948, p. 11

Energy rate: (Monthly)

5.0¢ per kwh for first 300 kwh
4.0¢ " " " next 700 kwh
3.0¢ " " " " 1000 kwh
2.5¢ " " " all additional kwh

Minimum monthly bill: 75¢ per hp for first 50 hp of connected load, plus 50¢ for each additional hp

Minimum yearly bill: $8.00 per hp of connected load.

Firm F FPC (102) Ark., Apr. 7, 1952, p. 11

Energy rate: (Monthly)

5¢ per kwh first 400 kwh
3¢ " " next 600 kwh
2¢ " " all over 1,000 kwh

Firm F (continued)

Minimum bill: (Monthly)

$1.00 per hp for first 2 hp of connected load
0.50 " " " next 8 hp of connected load
0.25 " " " all over 10 hp of connected load.

Firm G — FPC (125) Ark., Dec. 1, 1940, p. 13

Energy rate: (Monthly)

2.5¢ per kwh first 100 kwh per hp connected load
2.0¢ per kwh all additional kwh

Minimum bill: (Season)
$6.00 per hp.

SOUTHWESTERN OKLAHOMA

Firm H: — FPC (105) Okla. Mar. 15, 1953, p. 12

Energy rate: (Monthly)

6¢ per kwh for first 100 kwh
5¢ " " " next 200 kwh
4¢ " " " " 300 kwh
2¢ " " " all over 600 kwh

Minimum monthly bill: $1.00 for first hp plus $0.50 for each additional hp or fraction thereof of connected load.

Firm I: — FPC (120) Okla. Mar. 1, 1953, p. 12

Energy rate: (Monthly - for less than 5,000 kwh)

7.5¢ per kwh for first 50 kwh
5.5¢ " " " next 100 kwh
3.5¢ " " " " 500 kwh
3.0¢ " " " all over 650 kwh

Minimum bill: (Monthly) $2.00.

Firm I (continued) FPC (121) Okla. 1960, p. 13.

Energy rate: (Monthly - for 5,000 kwh and over)

4.00¢ per kwh	first	200 kwh
3.50¢ " "	next	300 kwh
2.75¢ " "	"	1000 kwh
2.50¢ " "	"	1500 kwh
2.25¢ " "	"	2000 kwh
2.00¢ " "	"	5000 kwh
1.90¢ " "	all additional.	

Firm J: Okla. REA 1959-60 rate

Demand charge: (Monthly)

$1.25 per kw of billing demand

Energy rate: (Monthly)

2.5¢ per kwh	first 50 kwh per kw
1.5¢ " "	next 100 kwh per kw
0.8¢ " "	all additional kwh used in month

Minimum annual bill:
$9.00 per kva of installed transformer capacity.

Firm K: FPC (149) Okla., Dec. 2, 1946, p. 15

Energy rate: (Monthly)

4.00¢ per kwh	first	200 kwh
3.50¢ " "	next	300 kwh
2.75¢ " "	"	1000 kwh
2.50¢ " "	"	1500 kwh
2.25¢ " "	"	2000 kwh
2.00¢ " "	"	5000 kwh
1.90¢ " "	all additional kwh	

Minimum monthly bill: $1.00

Prompt payment discount: 10% discount if bill is paid by 10th of month.

Firm L: FPC (25) Okla., Jan. 1, 1960, p. 4

Energy rates: (Monthly)

$1.00 per month for first 12 kwh or less
4.80¢ per kwh next 88 kwh
3.85¢ " " " 400 kwh
3.30¢ " " " 500 kwh
2.75¢ " " all additional kwh

Minimum bill: (Monthly)

$1.00 for first hp plus $0.50 for additional hp.

Firm M: FPC (87) Okla., Feb. 20, 1936, p. 10

Energy rate: (Flat - same monthly or year)

3¢ per kwh

Minimum bill: None

Fuel adjustment: Effective Apr. 1, 1960.

SOUTH TEXAS (Rio Grande Valley, Corpus Christi and El Campo Areas)

Firm N FPC (420) Texas, Dec. 13, 1957, p. 35

Demand charge: (Monthly)

$2.00 per kw first 50 kw
1.50 " " all over 50 kw

Energy rate: (Monthly)

3.0¢ per kwh first 1,000 kwh
2.0¢ " " next 2,000 kwh
1.5¢ " " all additional kwh

Minimum monthly bill:

Demand charge but for not less than 50 kw.

Firm O FPC (16) Texas, Dec. 1, 1952, p. 3

Demand charge: (Monthly)

$2.22 per kw first 50 kw
1.66 " " all additional kw

Firm O (continued)

Energy rate: (Monthly)

4.44¢	per	kwh	first 100 kwh
3.33¢	"	"	next 1,000 kwh
2.22¢	"	"	next 10,000 kwh
1.66¢	"	"	all additional kwh

Maximum rate: Should net cost in any month exceed 4.44¢ per kwh, billing at above charges will be waived and all kwh used in such month will be billed at the rate of 4.44¢ per kwh.

Prompt payment discount: 10%, 10 days

Minimum seasonal bill: $6.66 gross per season per kw of maximum measured demand or 60 percent of connected load, whichever is greater.

Firm P — FPC (96) Texas, Nov. 1957, p. 11

Energy rates: (Monthly)

$1.25 first 12 kwh or less				
2.9¢	per	kwh	next	238 kwh*
2.0¢	"	"	"	350 kwh*
1.5¢	"	"	"	2,000 kwh
0.9¢	"	"	"	6,000 kwh
0.7¢	"	"	"	75,000 kwh
0.6¢	"	"	all additional kwh	

* For each kva demand in excess of 3 kva, the 2.9¢ and 2.0¢ blocks of the above rate will each be increased by addition of the following:

100	kwh	per	kva	demand	first 2 kva over 3 kva
75	"	"	"	"	next 15 " " 5 "
40	"	"	"	"	" 80 " " 20 "
31	"	"	"	"	all over 100 kva

Load factor discount: 0.1¢ per kwh for each kwh in excess of 360 kwh per kva demand.

Fuel adjustment: Applied in 1959-60

Firm P (continued)

Minimum bill: If upon expiration of any 24 consecutive monthly billings, subsequent to date service is first supplied under this rate schedule, customer's total payments are not equal to or more than $12 per kva for each kva in excess of 5 kva of the maximum kva supplied during such period, utility may remove its facilities unless customer agrees to pay a minimum billing equivalent to $12 for each kva in excess of 5 kva of the maximum kva required to satisfy customer's service requirements for the next 24 consecutive monthly billings or any fraction thereof.

(Note--In calculating bill in table 1 for above firm, $6 per kva was used to figure minimum bill. If maximum kva and kwh used were the same in preceding year, that procedure would give same result as $12 per kva. Minimum bill did not apply at level of power consumption used to figure bills in table 1.)

Firm Q — Texas REA rate, 1959-60

Demand charge: (Monthly)

$0.75 per kw of billing demand

Energy rates: (Monthly)

2.0¢ per kwh first 50 kwh per kw
1.5¢ " " next 100 kwh per kw
0.8¢ " " all additional kwh per kw

Minimum seasonal bill: As agreed on in contracts

Firm R — FPC (568) Texas, Jan. 1, 1958, p. 47

Demand charge: (Monthly)
$1.75 per kw first 50 kw demand
1.50 " " all over 50 kw demand

Energy rate: (Monthly)

2.25¢ per kwh first 1,000 kwh
1.75¢ " " next 4,000 kwh
1.25¢ " " " 5,000 kwh
1.00¢ " " " 30,000 kwh
0.90¢ " " " 60,000 kwh
0.80¢ " " " 200,000 kwh
0.70¢ " " all additional kwh

Firm R (continued)

Minimum bill: The demand charge.

Billing demand: The maximum 30-minute measured demand in the month, subject to power factor adjustment, but not less than 60% of the highest demand established in the preceding 11 months.

TEXAS BLACKLAND

Firm S — FPC (482) Texas, Apr. 1, 1951, p. 39

Demand Charge: (Operating season)

$2.75 per hp connected load

Energy rate: (Operating season)

2.5¢ per kwh

Minimum bill: The demand charge.

Firm T — FPC (501) Texas, 1929, p. 42

Energy rate:

3¢ per kwh

Minimum bill: (Monthly) $0.75 for first hp of connected load, plus $0.50 per hp for all additional hp of connected load.

Firm U — FPC (321) Texas, Mar. 1, 1951, p. 26

Demand charge: (Operating season - Aug. 1 to Mar. 1)

$3.10 per horsepower of connected load

Energy rate: (Operating season)

2.7¢ per kwh all kwh used

Fuel adjustment: Applied in 1959-60

Tax adjustment: Applied in 1959-60

Minimum bill: The demand charge.

Firm V — FPC (413) Texas, Jan. 1, 1947, p. 35

Energy rate: (Monthly)

6¢ per kwh first 100 kwh
3¢ " " next 500 kwh
2¢ " " all over 600 kwh

Firm W — Texas REA 1959-60 rate

Demand charge: (Monthly)

$1.25 per kw of billing demand

Energy rate: (Monthly)

2.0¢ per kwh first 50 kwh per kw
1.2¢ " " next 100 kwh per kw
0.8¢ " " all additional kwh used

Minimum bill: Stated in individual contracts

Firm X — Texas REA 1959-60 rate

Demand charge: (yearly)

$6.00 per hp connected

Energy rate: (yearly)

1.5¢ per kwh used

Minimum yearly bill: Demand charge

Firm Y — Not in FPC Texas rate book

Energy rate: (Monthly)

3.75¢ per kwh first 60 kwh per kw*
2.00¢ " " next 30 kwh per kw
1.25¢ " " next 20 kwh per kw
1.00¢ " " all additional kwh

*Kw computed at 75 percent of horsepower of connected motors by this firm.

Firm Y (continued)

Minimum monthly bill:

$1.25 per kw first 10 kw
0.50 " " all additional kw

Firm Z — FPC (555) Texas, June 1, 1959, p. 46

Energy rate: (Monthly - for use of over 34 kwh)

4.0¢ per kwh first 100 kwh
2.5¢ " " next 900 kwh
2.0¢ " " " 4,000 kwh
1.5¢ " " " 15,000 kwh
1.0¢ " " all additional kwh

Minimum monthly bill: $2.00

Firm AA — Texas REA 1959-60 rate

Demand charge: (Yearly)

$6.00 per connected hp

Energy rate: (Monthly)

1.50¢ per kwh first 50 kwh per connected hp
1.25¢ " " all additional kwh

Minimum yearly bill: $6.00 per hp or fraction thereof of connected load but not less than $60.00.

Firm BB — Texas REA 1959-60 rate

Energy rates: (Season)

6.0¢ per kwh first 100 kwh per hp
1.5¢ " " all additional kwh

Minimum bill for season: $6.00 per hp or fraction thereof, of connected load but not less than $60.00.

Firm CC | FPC (203) Texas, June 4, 1955 - July 2, 1956, p. 19

Energy rate: (Monthly)

5.5¢ per kwh first 100 kwh
4.0¢ " " next 200 kwh
3.7¢ " " " 800 kwh*
1.9¢ " " all additional kwh

*Add to 3.7¢ block 100 kwh for each kw demand in excess of 10 kw. Kw determined on 30 minute period.

Fuel adjustment: Applied in 1959-60

Minimum for year: $9.00 per kw of maximum kw in year but not less than $100.00

Firm DD-1[2] | FPC (281) Texas, Apr. 6, 1951, p. 22

Energy rate: (for season)

5.5¢ per kwh first 70 kwh per hp
4.4¢ " " next 25,000 kwh
3.3¢ " " " 25,000 kwh
2.2¢ " " all additional kwh

Minimum bill: $24.00 per hp for first 50 hp plus $12.00 per hp in excess of 50 hp during each consecutive 2 year period.

(Note--One-half of above minimums were used for checking bills in table 1, but minimum did not apply.)

Firm DD-2[2] | Note in FPC rate book--similar to FPC (264) Texas, Apr. 15, 1951, p. 21

Energy rate: (Monthly)

$1.60 which includes 10 kwh
4.4¢ per kwh next 360 kwh*
3.2¢ " " " 600 kwh
2.8¢ " " " 650 kwh
2.1¢ " " " 2,500 kwh
1.1¢ " " all additional kwh

*Add to 4.4¢ block 90 kwh for each kw demand in excess of 4 kw. (Kw demand based on 15 minute period of maximum use during month)

[2] Firm DD-1 and DD-2 are same company but different rate schedules (1 and 2) used for fully electrified gins.

Firm DD-2 (continued)

Minimum monthly bill: $1.60 plus $1.50 for each kw of demand in excess of 4 kw.

Firm EE — FPC (378) Texas, Apr. 1, 1959, p. 31

Demand charge: (Yearly)

Includes 160 kwh per year per hp
$7.95 per year per hp first 100 hp connected load
$6.00 per year per hp all additional hp connected load
one third of demand charge payable at the end of each of first 3 months of contract year

Energy rate: (Yearly)

2¢ per kwh for all kwh used in excess of 160 kwh per hp included in demand charge.

Minimum bills: Demand charge for year. Minimum monthly bill $2.50 for each of 9 months after demand charges are paid

Fuel adjustments: Applied in 1959-60

☆ U. S. GOVERNMENT PRINTING OFFICE 1961 O - 595554

Other Publications Available

Effect of Grades and Weights on Cottonseed Margins of Cooperative Gins. General Report 55. William C. Bowser, Jr.

Using Your Co-op Cotton Gin. Educational Circular 15. William C. Bowser, Jr.

Mechanical Sampling of Cotton. Marketing Research Report 412. Maurice R. Cooper, J. D. Campbell, and D. L. Pritchard. (Request copies of this publication from Agricultural Marketing Service, U.S. Department of Agriculture.)

Baling Cotton at Gins, Practices and Costs, Flat, Standard, High Density Bales. Marketing Research Report 386. J. D. Campbell and R. C. Soxman.

Controlling Protein Level of Meal Production at Cottonseed Oil Mills. Marketing Research Report 437. Elmer J. Perdue and Dale J. Peier.

Using Gin Machinery More Effectively. Bulletin 7. Otis T. Weaver and Daniel H. McVey.

A copy of each of these publications may be obtained while a supply is available from--

Information Division

Farmer Cooperative Service

U. S. Department of Agriculture

Washington 25, D. C.

Growth Through Agricultural Progress