OKLAHOMA
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
C. P. BLACKWELL, Director
Stillwater, Oklahoma

Rural Electrification in Oklahoma

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Experiment Station Bulletin No. 207 December, 1932

The rates used in calculating costs in this bulletin are now obsolete. For present rates, inquire at the nearest office of the concern supplying you power.

RURAL ELECTRIFICATION IN OKLAHOMA
A STUDY OF CONSUMPTION AND COSTS

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INTRODUCTION

Rural Electrification is a relatively new development. In 1925 none of the public utilities in Oklahoma were prepared to offer farm service. In 1927 the first farm line in the state was built at Pauls Valley. Much progress has been made since that time. According to the 1930 census, the per cent of farms electrified was as follows:

Per cent of Farms Electrified

	Individual Lighting Plant	Central Station	Total Electrified
Oklahoma	2.04%	1.93%	3.97%
United States	4.33%	9.07%	13.40%

The National Electric Light Association reports in 1932 that the percentage electrified from central station service has increased to 2.63% for Oklahoma and 11.2% for the United States. Small as is the percentage of Oklahoma farms with central station service in 1932 it represents an increase of 36.3% in two years during a serious economic depression. No corresponding data is available concerning individual plants for this same two-year period. Oklahoma is still far below the national average for electrified farms, yet while Oklahoma has an increase of 36.3% in two years for farms electrified from central station service, that for the United States is 21.3%.

The Oklahoma Committee on the Relation of Electricity to Agriculture, which is a branch of the corresponding national committee, has been sponsoring educational activities relating to rural electrification. It has members from the A. and M. College, the agricultural press, individual lighting plant manufacturers, electric utility companies, and farmers from various sections of the state who are leaders in their communities.

The Committee sensed a distinct need for accurate information on the energy consumption of various farm electric devices in Oklahoma, as well as the suitability of the devices for the work to be done. Similar investigations had been made in several states, but the results of those surveys were not applicable directly in Oklahoma because of possible differences in local conditions. Since the committee was aware of the needs for this data, it sponsored the organization of a Rural Electrification Project under the joint auspices of the A. and M. College Agricultural Experiment Station and the Oklahoma Utilities Association.

Mr. Earl R. Miller was employed to take active charge of the field work and prepare this report. He was reared on a farm, has farmed for himself, has received college degrees in agricultural and electrical engineering, and is therefore well fitted by training and experience for the duties above mentioned.

This project has been made possible thru the cooperation of many interested parties. The Oklahoma Committee on the Relation of Electricity to Agriculture gratefully acknowledges the able assistance of the following individuals and groups:

Twenty-two cooperating farmers, whose names appear repeatedly in this report.

The Oklahoma Utilities Association, Mr. E. F. McKay, Manager, representing

The Oklahoma Gas and Electric Company
Public Service Company of Oklahoma
Southwestern Light and Power Company
Oklahoma Power and Water Company

The A. and M. College, the Agricultural Experiment Station and the Extension Division, represented by

President Henry G. Bennett
Dean Carl P. Blackwell, Agriculture
Dean Philip S. Donnell, Engineering
Dean Nora A. Talbot, Home Economics
Mr. D. P. Trent, Director of Extension
Prof. L. E. Hazen, Agricultural Engineering

In addition to those listed there were a number who offered suggestions and rendered assistance.

The Committee expresses its appreciation to Mr. Earl R. Miller for the able work that he has done in this project.

It has been a privilege to be in daily contact with this investigation.

A. NAETER
Chairman of Oklahoma Committee on Relation of Electricity to Agriculture, Head of Electrical Engineering Department, Oklahoma A. and M. College.

Stillwater,
Nov. 1932

METHODS OF PROCEDURE

After the project initiated by the State Committee on the Relation of Electricity to Agriculture had been approved by the various cooperating agencies, the Agricultural Experiment Station set about the proposed task of determining the operating cost and practicability of electric equipment operated on Oklahoma farms. For this study 22 typical eletrified farms located in various parts of the state but within a radius of 125 miles from Stillwater were selected. These consisted of dairy, poultry, and general farms. Each was visited, a check made of the electric equipment used, and the cooperation of the farmers solicited. The power companies supplying the farms with service were asked to set individual meters on the equipment which was chosen for study. In compliance with this request 92 individual meters were set, which, with 24 master meters registering farm consumption, gave a total of 116 meters from which data were taken.

Following the college practice of calibrating all instruments, a standard watt-hour meter was purchased for the calibration of all meters used. The standard meter was checked for accuracy at the Bureau of Standards in Washington, D. C., when purchased and rechecked at regular intervals thereafter. At the beginning of the project each of the 92 meters set on individual equipment was calibrated and then sealed with the college sealing iron. When the project was completed each meter was rechecked to see that the calibration was not in error greater than the limit allowed by the State Corporation Commission and that the seals had not been broken. The 24 master meters recording total farm consumption are checked for calibration at regular intervals by the power companies and kept within the limits of accuracy prescribed by the State Corporation Commission. Since these meters were sealed by the power companies they were not tested by the College, consequently the total farm consumptions, and the consumptions of lights and miscellaneous, which is the difference of individual meter totals and master meter, were not recorded by College calibrated meters.

In order to keep an accurate check on the operation of equipment and the duty performed, special data sheets were supplied each farmer for the equipment metered on his farm. Once a month each farm was visited, the meters read and the individual records kept by the farmer collected. The amount of milk handled, the grain ground, eggs incubated, clothes washed, etc., were secured from the individual farm records, from monthly sales records, and from multiplying an average day's record by the number of days in the month. The weights in many cases were estimated by the farmers and as such may vary slightly from the actual amount.

In writing this report the monthly meter readings of energy consumption were adjusted to correspond to the calendar months. The total farm bill was computed by using the power company billing rate for each farm and the College readings of consumption for the calendar month. Since the College readings were not taken on the same days as the power company readings the monthly bills may vary a few cents from the amounts actually paid by the farmers.

COOPERATING FARMS

T. T. BAKER—BAKERDALE DAIRY

General Facts: Mr. T. T. Baker's address is R. F. D. No. 1, Sapulpa, Oklahoma. The farm is located 5 miles south and 1½ miles west of Sand Springs, Oklahoma. It is a dairy farm with 480 acres of land most of which is kept in pasture. The land is owned by Mr. J. F. Murphy and leased to Mr. Baker for dairy purposes. The farm income is derived from the sale of milk, surplus dairy cattle, and a few hogs. Around 50 cows are milked throughout the year and the milk retailed to customers in Tulsa, Oklahoma. The farm is managed and operated by Mr. Baker and family. The family consists of Mr. and Mrs. Baker and daughter. Seven hired men are kept the year round and additional help hired in the rush season. The farm is supplied electricity from a 2300 volt primary line through a 10 kva. transformer. A 220 volt 2-wire service is run from the transformer to a 60 ampere entrance switch for power, and a 110-220 volt 3-wire service is run from the transformer to a 30 ampere entrance switch for lights. The connected load of the farm consists of 3.2 kw. in lights, and 11.6 kw. in equipment, a total of 14.8 kw. The wiring and fixtures for the farm were installed at a cost of around $300.

The Home: The residence is a seven-room wooden structure equipped with electric lights, running water, sewage disposal system, and natural gas heat. Electric conveniences used in the home besides lights are flat iron, vacuum cleaner, sewing machine, toaster, waffle iron, portable fan and radio. The cost of this equipment when purchased was estimated to be $445.

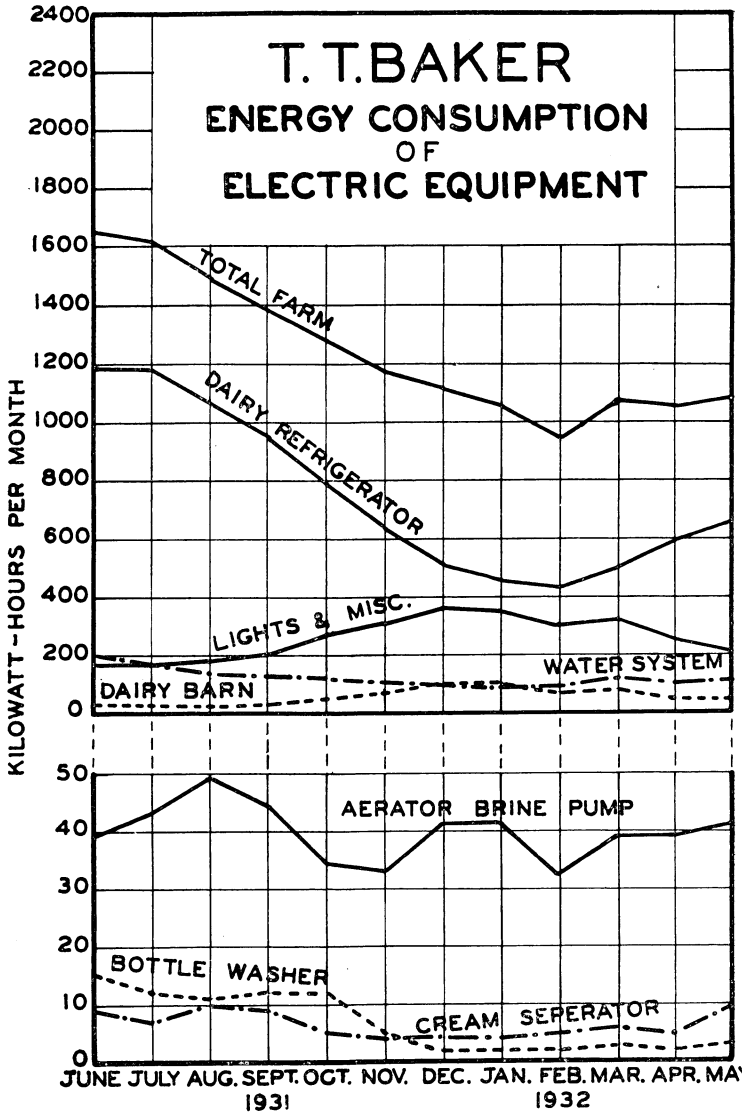
Tenant Houses: There are 4 houses located on the farm in addition to the home residence. These houses are the homes of the hired men and families. They are all wooden structures, two of which have 2 rooms, one 3 rooms and one 4 rooms. Three of them are equipped with electric lights, running water, and natural gas heat. The other is located apart from the home improvements and is not supplied with electricity. In addition to lights, an electric flat iron is used in each home supplied with electricity.

Farm Buildings: The improvements in addition to houses consist of milk house, dairy barn, feed house, cow shed, calf shed, poultry house, garage and silo. The milk house, dairy barn, feed house, cow shed and garage are wired for and equipped with lights. The milk house is equipped with running water and natural gas heat in addition to lights.

Farm Equipment: The electric equipment on the farm consists of dairy refrigerator, aerator brine pump, cream separator, bottle washer and deep well pressure water system that supplies running water to the houses, milk house, and barn lot. The cost of this equipment when purchased was estimated to be $4300.

Livestock and Poultry: An inventory of August 3, 1931, gave 120 head of cattle, 5 horses, 70 hogs, and 100 chickens.

Crops: The 1931 production was 60 acres of corn, 50 acres of oats, 125 acres of tame pasture, and 150 acres of wild pasture. All feed grown was fed to stock on the farm. In addition to that grown, considerable hay and dairy feed were purchased throughout the year.


T. T. BAKER
ENERGY CONSUMPTION
OF
ELECTRIC EQUIPMENT
KILOWATT-HOURS PER MONTH
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
50
40
30
20
10
0
TOTAL FARM
DAIRY REFRIGERATOR
LIGHTS & MISC.
WATER SYSTEM
DAIRY BARN
AERATOR BRINE PUMP
BOTTLE WASHER
CREAM SEPERATOR
JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY
1931
1932

T. T. Baker—Bakerdale Dairy

Monthly Kilowatt-hour Consumption of Electric Equipment From May, 1931, to June, 1932.

Month	Total kw-hr.	Water system†	Dairy refrigerator*	Aerator brine pump	Cream separator	Bottle washer	Dairy Barn lights	Lights and misc.
June	1648	198	1189	39	9	15	31	167
July	1615	168	1181	43	7	12	29	175
August	1487	145	1063	49	10	11	24	185
September	1381	136	945	44	9	12	34	201
October	1277	126	787	34	5	12	48	265
November	1166	108	637	33‡	4	5	75	304
December	1117	100	509	41	4	2	102	359
January	1054	94	461	41	4	2	102	350
February	943	93	434	32	5	2	76	301
March	1069	117	499	39	6	3	84	321
April	1052	104	593	39	5	2	56	253
May	1083	103	660	41	9	3	55	212
TOTAL	14892	1492	8958	475	77	81	716	3093
Average	1241	124.3	746.5	39.6	6.4	6.8	59.7	257.7

T. T. Baker—Bakerdale Dairy

Monthly Energy Consumption Cost of Electric Equipment From May, 1931, to June, 1932.

Month	Total bill	Average cost per kw-hr.	Water system†	Dairy refrigerator*	Aerator brine pump	Cream separator	Bottle washer	Dairy barn lights	Lights and misc.
June	$56.44	3.43¢	$6.78	$40.72	$1.34	$0.31	$0.51	$1.06	$5.72
July	55.45	3.43	5.77	40.54	1.48	0.24	0.41	1.00	6.01
August	51.61	3.47	5.03	36.90	1.70	0.35	0.38	0.83	6.42
September	48.43	3.51	4.77	33.14	1.54	0.32	0.42	1.19	7.05
October	45.31	3.55	4.47	27.92	1.21	0.18	0.43	1.70	9.40
November	41.98	3.60	3.89	22.93	1.19‡	0.14	0.18	2.70	10.95
December	40.51	3.63	3.63	18.46	1.49	0.14	0.07	3.70	13.02
January	38.62	3.66	3.44	16.89	1.50	0.15	0.07	3.74	12.83
February	35.29	3.74	3.48	16.24	1.20	0.19	0.08	2.84	11.26
March	39.07	3.65	4.28	18.24	1.42	0.22	0.11	3.07	11.73
April	38.56	3.67	3.81	21.74	1.43	0.18	0.07	2.05	9.28
May	39.49	3.65	3.76	24.06	1.49	0.33	0.11	2.01	7.73
TOTAL	$530.76		$53.11	$317.78	$16.99	$2.75	$2.84	$25.89	$111.40
Average	44.23	3.56¢	4.43	26.48	1.42	0.23	0.24	2.16	9.28

* This meter was not calibrated.

† The meter registration was in error greater than the allowable limit when final calibration was made; this is compensated for in the data given.

‡ The meter potential coil was found open, so the reading for the month was estimated.

Connected load in kilowatts: lights 3.2, equipment 11.6, total 14.8.

The water system furnishes water from a 150-foot well for an average of 17 people, 5 horses, 120 head of cattle, 36 hogs and 115 chickens and in addition, water for washing out dairy barn and milk house and for the cooling of the dairy refrigerator compressor.

The bottle washer was a ¼ horsepower motor with brush attached direct to the shaft. An average of 520 bottles were washed per day, requiring 1 hour and 15 minutes. 0.43 kilowatt-hours, at a cost of 1.5 cents, were used per 1000 bottles washed.

"Lights and misc." include the lights of four houses, garage and milk house, three yard lights and the following equipment: 4 flat irons, 2 radios, vacuum cleaner, sewing machine, waffle iron and toaster.

Dairy barn lights include feed house lights, cattle shed lights, and two yard lights that burn all night on dark nights.

T. T. Baker—Bakerdale Dairy
Dairy Refrigerator Record From May, 1931, to June, 1932.

Month	Total* kw-hr.	Total* cost	Pounds of milk cooled	Average pounds in storage continuously	Kw-hr. per 100 pounds cooled	Cost per 100 pounds cooled
June	1,228†	$42.06†	21,900	560	5.61	19.2¢
July	1,224	42.02	21,570	540	5.67	19.5
August	1,112	38.60	19,000	410	5.85	20.3
September	989	34.68	18,000	410	5.49	19.3
October	821	29.13	19,260	190	4.26	15.1
November	670	24.12	23,700	320	2.83	10.2
December	550	19.95	26,600	190	2.07	7.5
January	502	18.39	24,200	480	2.07	7.6
February	466	17.44	17,800	170	2.62	9.8
March	538	19.66	15,900	320	3.38	12.4
April	632	23.17	13,100	300	4.82	17.7
May	701	25.55	13,300	150	5.27	19.2
TOTAL	9,433	$334.77	234,330			
Average	786	27.90	19,528	337	4.03	14.3¢

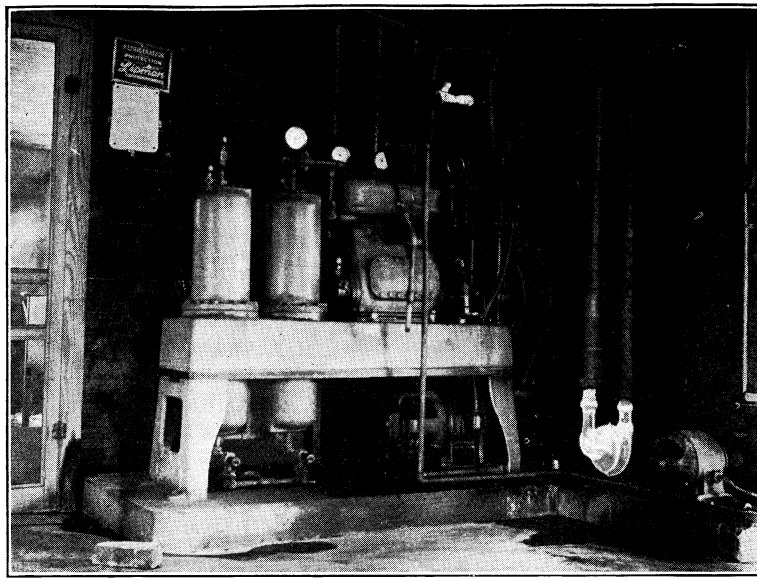
* Aerator included. † 3600 pounds of ice was frozen during the month.

Average temperature of cooled milk, 34°F.
Average temperature of box, 34°F.
Average pounds of milk cooled per day, 640.
Average time required per day for cooling, 3 hours and 10 minutes.
System of cooling: brine, with aerator and walk-in type box. Aerator capacity 100 gallons per hour.
Size of box 9x11x6 ft. Gallons of brine stored in box, 600.
The refrigerator compressor is a 2-ton water-cooled ammonia unit and is driven by a 5 horsepower motor.
The aerator brine circulator is a rotary pump driven by a 1 horsepower motor.

Cream Separator Record From May, 1931, to June, 1932.

Month	Kw-hr.	Cost	Total lbs. milk separated	Kw-hr. per 1000 lbs. milk	Cost per 1000 lbs. milk
June	9	$0.31	8,700	1.03	3.65¢
July	7	0.24	8,850	0.79	2.71
August	10	0.35	7,360	1.36	4.76
September	9	0.32	7,150	1.26	4.47
October	5	0.18	7,860	0.64	2.29
November	4	0.14	6,200	0.65	2.26
December	4	0.14	6,500	0.62	2.15
January	4	0.15	6,100	0.65	2.46
February	5	0.19	7,800	0.64	2.44
March	6	0.22	9,600	0.63	2.29
April	5	0.18	5,600	0.89	3.21
May	9	0.33	11,500	0.78	2.87
TOTAL	77	$2.75	93,220		
Average	6.4	0.23	7,768	0.83	2.95¢

The separator is run on an average of one hour per day for the separating of 255 pounds of milk. It has a capacity of 500 lbs. per hour and is driven by a ¼ horsepower motor.



A two-ton ammonia refrigerator unit used with walk-in type box and aerator for cooling milk at Mr. T. T. Baker's.

D. D. BANTA

General Facts: Mr. D. D. Banta's address is Tuttle, Oklahoma. The farm is located 1½ miles west of Tuttle. It is a general farm of 250 acres owned by Mr. Banta, and occupied by him and his family of 4 children and a housekeeper. The land is leased to and farmed by Mr. Hulsey, who, with his family, lives in a tenant house on the farm. During harvest and cotton picking extra help is hired to take care of the crops. The farm income is derived from the sale of cotton, grain, and a small amount of livestock. Electricity is supplied from a 13,200 volt primary line through a 5 kva. transformer. A 110-220 volt 3-wire service is run from the transformer to a 60 ampere entrance switch. The connected load consists of 0.9 kw. in lights, and 10.5 kw. in equipment, a total of 11.4 kw. The wiring for the farm was installed at a cost of around $85.

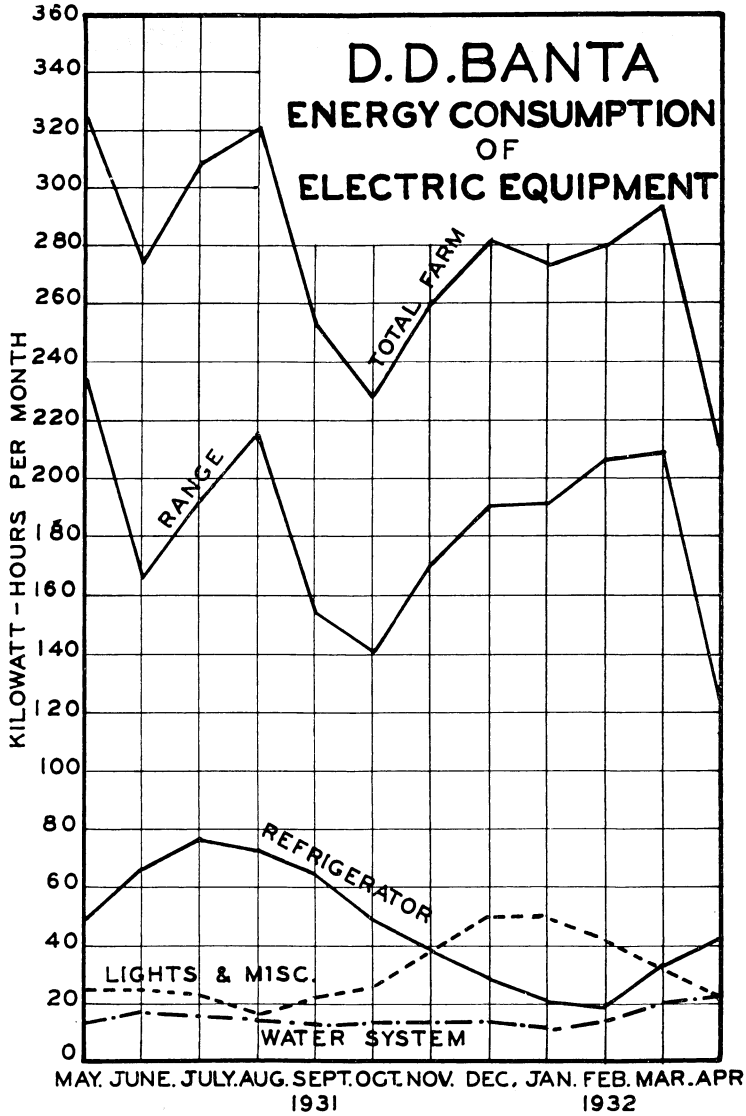
The Home: The residence is the home of Mr. Banta and family. It is a two-story wooden structure of 7 rooms equipped with electric lights, running water and sewage disposal system. A coal stove is used for heat during the winter months. The electric conveniences used in the home besides lights are electric range, refrigerator, radio, flat iron, washing machine, waffle iron, percolator, vacuum cleaner, and reflector heater. The cost of this equipment when purchased was estimated to be $775.

Tenant House: The house is the residence of Mr. Hulsey and family. It is a two room wooden structure, wired and equipped with lights. The energy used is metered separately and is not included in the consumption for the farm.

Farm Buildings: The improvements other than houses consist of general barn, cow shed, poultry house, garage, and smoke house. The barn, cow shed and garage are wired for lights and equipment.

Farm Equipment: The only electric equipment used outside the house was a pressure water system. This system was driven by a ½ horsepower motor, and supplied running water to the house, poultry, and barnyard from a deep well.

Livestock and Poultry: An inventory of the farm July 20, 1931, gave 5 head of cattle, 6 horses, 8 hogs, and 100 chickens.



Crops: The 1931 production was 60 acres of corn, 12 acres of oats, 10 acres of kafir, 12 acres of alfalfa, 80 acres of cotton, 35 acres wild pasture, and some garden and fruit for house use. Some of the feed grown was fed to stock on the farm, the remainder and the cotton was sold as a cash crop.

D. D. Banta

Monthly Kilowatt-hour Consumption of Electric Equipment
From April, 1931, to May, 1932.

Month	Total kw-hr.	Electric range	House refrigerator	Water system	Lights and misc.
May	322	233	50	14	25
June	275	166	67	17	25
July	309	193	77	16	23
August	320	216	73	15	16
September	254	154	65	13	22
October	228	140	49	14	25
November	261	171	38	14	38
December	282	190	28	14	50
January	274	192	21	11	50
February	280	206	18*	14	42
March	294	209	33	20	32
April	211	126	42	22	21
TOTAL	3310	2196	561	184	369
Average	275.8	183	46.75	15.3	30.75

Monthly Energy Consumption Cost of Electric Equipment
From April, 1931, to May, 1932.

Month	Total bill	Average cost per kw-hr.	Electric range	House refrig-erator	Water system	Lights and misc.
May	$14.66	4.55¢	$10.61	$2.27	$0.64	$1.14
June	13.25	4.82	8.00	3.23	0.82	1.20
July	14.27	4.62	8.91	3.56	0.74	1.06
August	14.60	4.56	9.86	3.33	0.68	0.73
September	12.62	4.97	7.65	3.23	0.65	1.09
October	11.84	5.19	7.27	2.54	0.73	1.30
November	12.83	4.92	8.40	1.87	0.69	1.87
December	13.46	4.77	9.07	1.34	0.67	2.38
January	13.22	4.82	9.27	1.01	0.53	2.41
February	13.40	4.79	9.86	0.86*	0.67	2.01
March	13.82	4.70	9.83	1.55	0.94	1.50
April	11.33	5.37	6.77	2.26	1.17	1.13
TOTAL	$159.30		$105.50	$27.05	$8.93	$17.82
Average	13.28	4.81¢	8.79	2.25	0.74	1.49

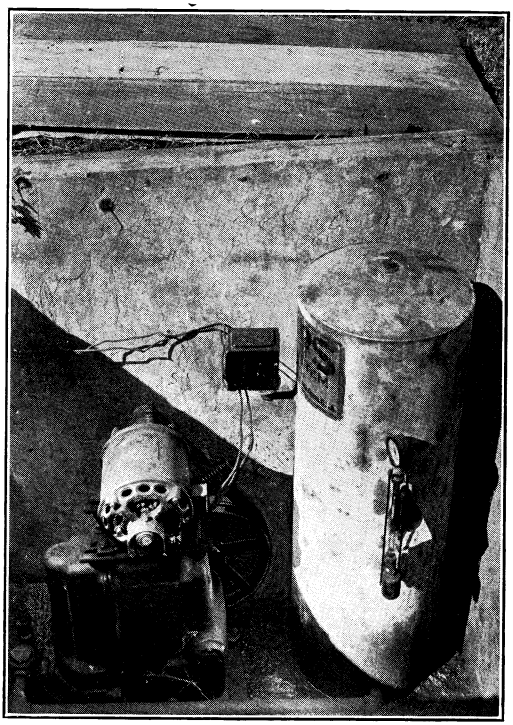
* The refrigerator was disconnected for about two weeks during the month.

Connected load in kilowatts: lights 0.9, equipment 10.5, total 11.4.

The water system furnishes water from a 50-foot well for an average of 6 people, 6 head of cattle, 5 horses, 15 hogs, and 210 chickens and in addition water for flowers.

"Lights and misc." include house lights, barn lights, garage lights, cellar lights, yard lights, radio, flat iron, waffle iron, percolator, vacuum cleaner, washing machine and reflector heater.

The refrigerator has a capacity of 5½ cu. ft.



Mr. D. D. Banta's deep well automatic water system that is located in a concrete lined pit to prevent freezing.

D. D. Banta

Electric Range Record From April, 1931, to May, 1932.

Month	Kw-hr.	Cost	Total meal units	Kw-hr. per 100 meal units	Cost per 100 meal units
May	233	$10.61	443	52.6	$2.40
June	166	8.00	323	51.4	2.48
July	193	8.91	372	51.8	2.40
August	216	9.86	372	58.6	2.65
September	154	7.65	348	44.2	2.20
October	140	7.27	328	42.7	2.22
November	171	8.40	360	47.5	2.33
December	190	9.07	372	51.0	2.44
January	192	9.27	372	51.6	2.49
February	206	9.86	348	59.1	2.83
March	209	9.83	372	56.2	2.64
April	126	6.77	300	42.0	2.26
TOTAL	2196	$105.50	4310		
Average	183	8.79	359	51	$2.45

The cooking was done on a three-plate and oven range, the connected load of which was 7 kilowatts. An average of 6 people were cooked for throughout the year. Only two meals were cooked per day most of the time; the third meal was a light lunch for which the range was seldom used. The cooking was done by a number of different people throughout the year, which resulted in quite irregular energy consumption.

Average kilowatt-hours required per person per month, 30.5.

Average cost per person per month, $1.47.

J. M. BEAUCHAMP ESTATE

General Facts: The address of the estate heirs, Mrs. Roy Bozorth, Mrs. B. L. Odom, and John, Lee, Fred and Sam Beauchamp, three of whom are not of age, is R. F. D. 4, Chickasha, Oklahoma. The farm is located 3 miles east and ½ mile south of Chickasha. It is a general farm of 480 acres of land. The farm income is derived from the sale of milk, grain and cotton, with the addition of some livestock sales. An average of 25 cows are milked during the year and the milk sold at wholesale in Chickasha. The farm is operated by Roy Bozorth, B. L. Odom, and Fred, John, Lee and Sam Beauchamp. One or two hired men are kept during the rush season and the cotton is hired picked. The farm improvements are located on the portion of land allotted to Lee Beauchamp, who is a minor. The two residences here are occupied by the Bozorth family and by the Odom family. The electric equipment on the farm is owned by Mr. Odom and Mr. Bozorth. The farm is supplied electricity from a 2300 volt primary line through a 1½ kva. transformer. A 110 volt 2-wire service is run from the transformer to a 30 ampere main switch. The connected load of the farm is 1.08 kw. in lights and 2.1 kw. in equipment, a total of 3.18 kw. The wiring and fixtures for the farm were installed at a cost of around $175.

The Home: The residence of Mr. Odom is a six-room wooden structure equipped with electric lights, running water, and natural gas heat. The electric conveniences used in the home other than lights are washing machine, radio, and flat iron. The cost of this equipment when purchased was estimated to be $158. The residence of Mr. Bozorth is a four-room wooden structure equipped with electric lights, running water and natural gas heat. Electric conveniences used in the house besides lights are radio and flat iron, the cost of which was estimated to be $108.

Tenant Houses: Besides the home residence, three additional houses are located on the farm. These are wooden structures of two, three, and five rooms. They are located apart from the home improvements and are not supplied with electric service.

Farm Buildings: The home improvements besides the houses consist of horse barn, dairy barn, hay barn, poultry house and silo. The horse barn, and dairy barn are wired for lights and equipment.

Farm Equipment: The milking machine is the only electric equipment used for agricultural purposes. The cost of this machine when purchased was estimated to be $350. Other power equipment used on the farm is farm tractor, truck, small gasoline engine, and windmill. The windmill and gasoline engine are used to pump water into an elevated storage tank that supplies running water to the houses and barnyard.

Livestock and Poultry: An inventory of the farm, July 21, 1932, gave 44 head of cattle, 12 horses, 10 hogs, 21 sheep, and 100 chickens.

Crops: The 1931 production was 190 acres of cotton, 100 acres of corn, 25 acres of kafir, 25 acres of oats, 8 acres of wheat, 15 acres of alfalfa, 20 acres of tame pasture, and 30 acres of wild pasture. A good part of the feed grown was fed to stock on the farm, the remainder and the cotton were sold as a cash crop.

J. M. Beauchamp Estate

Monthly Kilowatt-hour Consumption of Electric Equipment
From May, 1931, to June, 1932.

Month	Total kw-hr.	Milking machine	Washing machine	House lights	Lights and misc.
June	113	37	6	32	38
July	112	41	6	30	35
August	103	42	7	22	32
September	109	42	6	25	36
October	135	47	5	38	45
November	150	44	7	48	51
December	170	47	5	57	61
January	166	41	5	59	61
February	185	38	4	89*	54
March	209	39	6	118*	46
April	126	36	9	43	38
May	106	38	8	27	33
TOTAL	1684	492	74	588	530
Average	140.3	41	6.2	40.7*	44.2

Monthly Energy Consumption Cost of Electric Equipment
From May, 1931, to June, 1932.

Month	Total bill	Average cost per kw-hr.	Milking machine	Washing machine	House lights	Lights and misc.
June	$ 8.39	7.43¢	$2.75	$0.44	$2.38	$2.82
July	8.36	7.46	3.06	0.45	2.24	2.61
August	8.09	7.85	3.30	0.55	1.73	2.51
September	8.27	7.58	3.19	0.45	1.90	2.73
October	9.05	6.70	3.15	0.34	2.55	3.01
November	9.50	6.33	2.79	0.44	3.04	3.23
December	10.10	5.94	2.79	0.30	3.39	3.62
January	9.98	6.01	2.46	0.30	3.55	3.67
February	10.55	5.70	2.17	0.23	5.07*	3.08
March	11.27	5.39	2.10	0.32	6.37*	2.48
April	8.78	6.97	2.51	0.63	2.99	2.65
May	8.18	7.72	2.93	0.62	2.08	2.55
TOTAL	$110.52		$33.20	$5.07	$37.29	$34.96
Average	9.21	6.56¢	2.77	0.42	2.65*	2.91

* An estimate of 32 kilowatt-hours in February and 68 kilowatt-hours in March was used off the house light meter for the brooding of chicks; this was subtracted from the total in computing monthly average.

Connected load in kilowatts: lights 1.08, equipment 2.1, total 3.18.

The house lights are for the residence of Mr. Odom and include a radio and a flat iron.

"Lights and misc." include flat iron, radio, horse barn lights, dairy barn lights and the lights of Mr. Bozorth's residence.

Roy B. Bozorth

Milking Machine Record From May, 1931, to June, 1932.

Month	Kw-hr.	Cost	Total pounds milk	Kw-hr. per 1000 pounds milk	Number cows	Kw-hr. per cow per mo.	Cost per cow per mo.
June	37	$2.75	13,300	2.78	26	1.42	10.6¢
July	41	3.06	13,900	2.95	26	1.58	11.8
August	42	3.30	13,800	3.04	27	1.56	12.2
September	42	3.19	14,500	2.90	28	1.50	11.4
October	47*	3.15*	10,300	4.27	24	1.83	12.3
November	44*	2.79*	11,700	3.59	24	1.75	11.1
December	47*	2.79*	12,200	3.61	25	1.72	10.4
January	41	2.46	10,300	3.98	25	1.64	9.8
February	38	2.17	9,000	4.22	24	1.58	9.0
March	39	2.10	10,100	3.86	24	1.63	8.8
April	36	2.51	9,800	3.67	23	1.57	10.9
May	38	2.93	9,600	3.96	23	1.65	12.7
TOTAL	492	$33.20	138,500				
Average	41	2.77	11,300	3.50	25	1.62	10.9¢

* An estimate of 3 kilowatt-hours in October and December and 2 kilowatt-hours in November were used off the milking machine meter for lights; this was subtracted in computing unit values.

Average cost per 1000 pounds of milk, 23.6¢.

Average time required per day for milking, 2 hours and 20 minutes.

The milking was done with a 2-unit machine of the pipe line type, equipped with magnetic pulsator, and driven by a ½ horsepower motor.

B. L. Odom

Washing Machine Record From May, 1931, to June, 1932.

Month	Kw-hr.	Cost	Machines of dry clothes	Kw-hr. per 10 machines	Cost per 10 machines
June	6	$0.44	46	1.30	9.6¢
July	6	0.45	38	1.58	11.8
August	7	0.55	47	1.50	11.7
September	6	0.45	37	1.62	12.2
October	5	0.34	24	2.08	14.2
November	7	0.44	37	1.89	11.9
December	5	0.30	37	1.35	8.1
January	5	0.30	41	1.22	7.3
February	4	0.23	29	1.38	7.9
March	6	0.32	51	1.18	6.3
April	9	0.63	84	1.07	7.5
May	8	0.62	69	1.16	9.0
TOTAL	74	$5.07	540		
Average	6.2	0.42	45	1.37	9.4¢

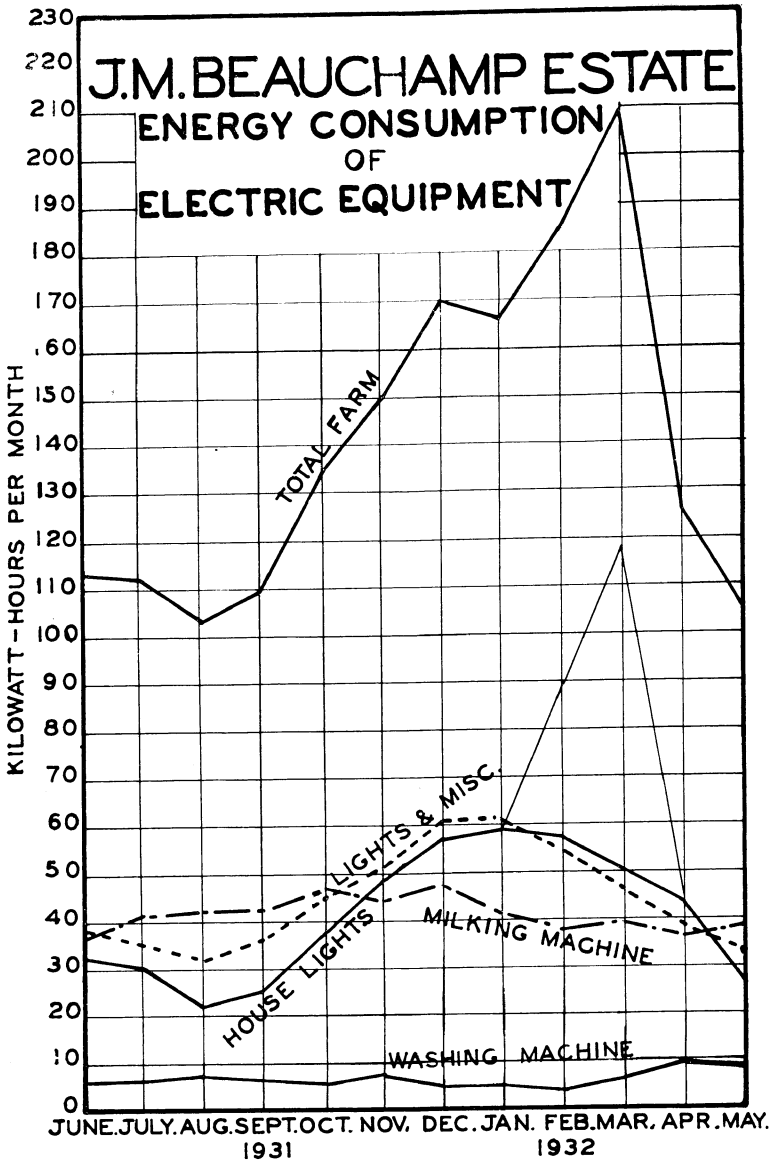
The machine was used to wash the clothes of two families having a total number of 7 people.

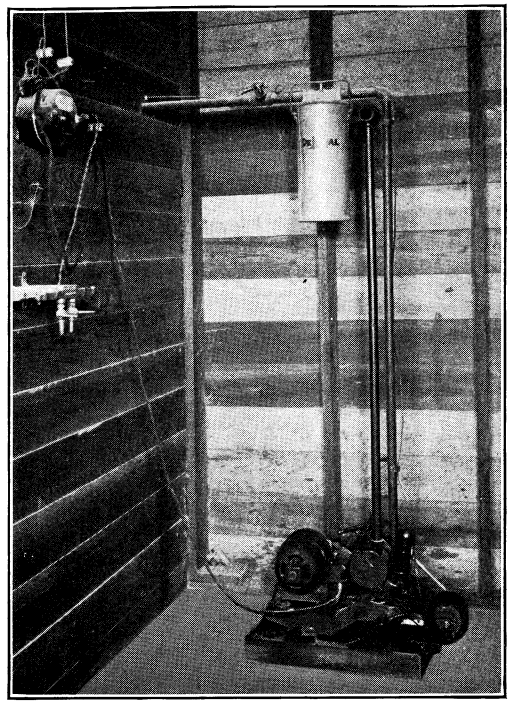
The average kilowatt-hours required per person per month was 0.88.

The average cost per person per month was 6 cents.

A six-sheet capacity gyrator type machine equipped with power wringer and driven by a ¼ horsepower motor was used.

It was run an average of 13 hours per month.


J.M. BEAUCHAMP ESTATE
ENERGY CONSUMPTION
OF
ELECTRIC EQUIPMENT
KILOWATT-HOURS PER MONTH
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
TOTAL FARM
LIGHTS & MISC.
HOUSE LIGHTS
MILKING MACHINE
WASHING MACHINE
JUNE. JULY. AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY.
1931
1932



Mr. Roy Bozorth's two-unit milking machine that was used for milking an average of 25 cows at a cost of 10.9 cents per cow per month.

C. R. BIRKS—SPRINGHILL DAIRY

General Facts: Mr. C. R. Birks' address is R. F. D. No. 6, Oklahoma City, Oklahoma. The farm is located 5½ miles west of Broadway on the Tenth Street Road out of Oklahoma City. It consists of 115 acres of land most of which is kept in pasture. The farm income is derived from the sale of milk and surplus dairy cattle. An average of 31 cows were milked during the year and the milk retailed to customers in Oklahoma City. The farm is owned, managed and operated by Mr. Birks and family. The family consists of Mr. and Mrs. Birks and two daughters. Two hired men are kept the year round and extra help hired during silo filling time. The farm is furnished electricity from a 4000 volt primary line through a 3 kva. transformer. A 110-220 volt 3-wire service is run from the transformer to a 60 ampere entrance switch. The connected load consists of a 2 kw. in lights and 4.78 kw. in equipment, a total of 6.78 kw. The wiring and fixtures for the farm were installed at a cost of around $300.

The Home: The house is a seven-room wooden structure. It is equipped with the modern conveniences of electric lights, kitchen sink, and has water piped into it. Electric conveniences other than lights are toaster, flat iron and radio. The cost of these was estimated to be $137.

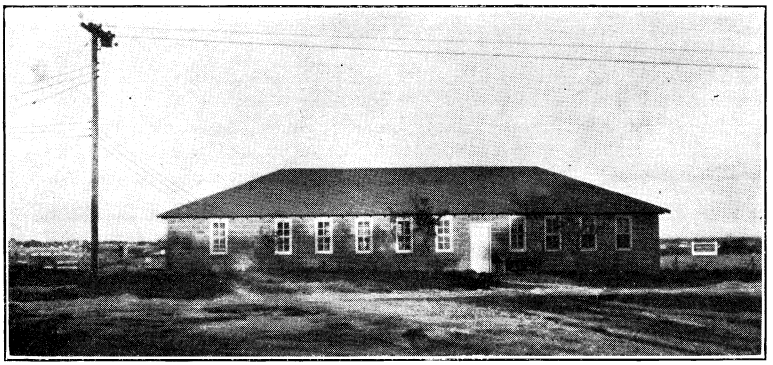
Tenant House: The tenant house is the residence of Mr. Fisher, one of the hired men. It is a wooden structure of five rooms, and is equipped with lights, kitchen sink and has water piped into it.

Farm Buildings: The improvements, in addition to the houses, are combined milk house and dairy barn, horse barn, cattle shed, poultry house, garage and two silos. All of the buildings are wired for and equipped with lights except the garage and poultry house. Water is piped into the milk house.

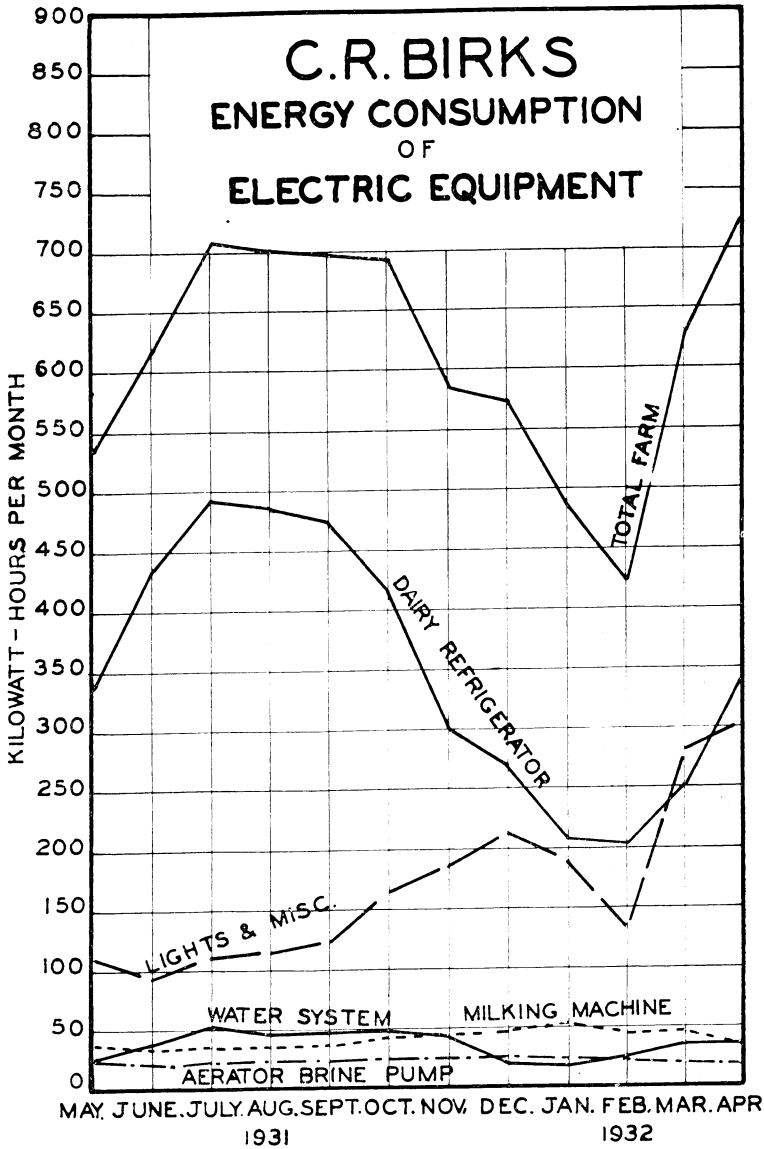
Farm Equipment: The electric equipment for agricultural purposes consists of milking machine, dairy refrigerator, aerator brine pump and motor, and a ½ horsepower motor used with pump jack. Water is pumped into a water tank for stock use and into storage tanks for house and milk house use. The cost of this equipment, when purchased, was estimated to be $1340.00. Other power equipment on the farm consists of a 1½ horsepower gasoline engine, which is not in use, and a motor truck.

Livestock and Poultry: An inventory of July 27, 1931, gave 42 head of cattle, 6 horses and 60 chickens.

Crops: The 1931 production was 20 acres of corn, 45 acres of tame pasture and 30 acres of wild pasture. All of the feed and pasture grown was consumed by stock on the farm. In addition to that grown, considerable dairy feed, hay and straw were purchased throughout the year for feed.



A combined dairy barn and milk house at Mr. C. R. Birks' in which an electrically driven dairy refrigerator and milking machine are used. At the top and left are shown the primary line, transformer and secondary distribution.


C.R. BIRKS
ENERGY CONSUMPTION
OF
ELECTRIC EQUIPMENT
KILOWATT-HOURS PER MONTH
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
TOTAL FARM
DAIRY REFRIGERATOR
LIGHTS & MISC.
WATER SYSTEM
MILKING MACHINE
AERATOR BRINE PUMP
MAY. JUNE. JULY. AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.
1931
1932

C. R. Birks—Springhill Dairy
Monthly Kilowatt-hour Consumption of Electric Equipment
From April, 1931, to May, 1932.

Month	Total kw-hr.	Aerator brine pump	Milking machine	Dairy refrigerator	Water system	Lights and misc.
May	535	23	36	340	27	109
June	618	20	33	434	37	94
July	709	22	35	491	52	109
August	700	22	35	485	45	113
September	697	22	35	471	46	123
October	692	24	41	415	47	165
November	585	23	42	300	41	179
December	573	24	48	269	21	211
January	486	21	51	207	18	189
February	423	20	44	203	24	132
March	631	19	44	252	35	281
April	723	17	35	337	33	301
TOTAL	7372	257	479	4204	426	2006
Average	614.4	21.4	40	350.3	35.3	167.1

Monthly Energy Consumption Cost of Electric Equipment
From April, 1931, to May, 1932.

Month	Total bill	Average cost kw-hr.	Aerator brine pump	Milking machine	Dairy refrigerator	Water system	Lights and misc.
May	$22.61	4.23¢	$0.97	$1.52	$14.37	$1.14	$4.61
June	25.22	4.08	0.82	1.35	17.71	1.51	3.83
July	28.09	3.96	0.87	1.39	19.45	2.06	4.32
August	27.80	3.97	0.87	1.39	19.26	1.79	4.49
September	27.71	3.98	0.87	1.39	18.73	1.83	4.89
October	27.55	3.98	0.96	1.63	16.52	1.87	6.57
November	24.18	4.13	0.95	1.74	12.40	1.69	7.40
December	23.80	4.15	1.00	1.99	11.18	0.87	8.76
January	21.07	4.34	0.91	2.21	8.98	0.78	8.19
February	19.08	4.51	0.90	1.98	9.16	1.08	5.96
March	25.63	4.06	0.77	1.79	10.24	1.42	11.41
April	28.53	3.95	0.67	1.38	13.30	1.30	11.88
TOTAL	$301.27		$10.56	$19.76	$171.30	$17.34	$82.31
Average	25.11	4.09¢	0.88	1.65	14.28	1.45	6.86

Connected load: lights 2 kilowatts, equipment 4.78 kilowatts, total 6.78 kilowatts.

The water system furnishes water from a 40-foot well for an average of 9 people, 44 head of cattle, 6 horses, and 120 chickens, and in addition water for washing out dairy barn and milk house.

"Lights and misc." include lights for 2 houses, horse barn lights, dairy barn and milk house lights, cattle shed lights, toaster, two irons, radio, waffle iron and hot plate.

C. R. Birks—Springhill Dairy
Milking Machine Record From April, 1931, to May, 1932.

Month	Kw-hr.	Cost	Total pounds milk	Kw-hr. per 1000 pounds milk	Number cows	Kw-hr. per cow per mo.	Cost per cow per mo.
May	36	$1.52	25,600	1.41	32	1.13	4.75¢
June	33	1.35	21,700	1.52	28	1.18	4.82
July	35	1.39	22,000	1.60	29	1.20	4.79
August	35	1.39	22,600	1.55	30	1.17	4.63
September	35	1.39	22,600	1.55	30	1.17	4.63
October	41	1.63	21,700	1.89	33	1.24	4.94
November	42	1.74	22,600	1.86	33	1.27	5.27
December	48	1.99	21,700	2.21	34	1.41	5.85
January	51	2.21	20,000	2.55	33	1.59	6.91
February	44	1.98	20,600	2.14	33	1.33	6.00
March	44	1.79	20,000	2.20	28	1.57	6.39
April	35	1.38	19,400	1.80	29	1.21	4.76
TOTAL	479	$19.76	260,500		371		
Average	40	1.65	21,708	1.84	31	1.29	5.33¢

Average cost per 1000 pounds of milk, 7.59 cents.

Average time required per day for milking, 2 hours and 50 minutes.

The milking machine is of the drive rod type. It is driven by a ½ horse-power motor. Three units are used for milking.

Dairy Refrigerator Record From April, 1931, to May, 1932.

Month	Total kw-hr.*	Total cost*	Pounds of milk cooled	Average lbs. in storage continuously	Kw-hr. per 100 pounds cooled	Cost per 100 pounds cooled
May	363	$15.34	25,600	207	1.42	5.99¢
June	454	18.53	21,700	181	2.09	8.54
July	513	20.32	22,000	178	2.33	9.24
August	507	20.13	22,600	182	2.24	8.91
September	493	19.60	22,600	189	2.18	8.67
October	439	17.48	21,700	175	2.02	8.06
November	323	13.35	22,600	189	1.43	5.91
December	293	12.18	21,700	172	1.35	5.61
January	228	9.89	20,000	161	1.14	4.95
February	223	10.06	20,600	172	1.08	4.88
March	271	11.01	20,000	172	1.36	5.52
April	354	13.97	19,400	175	1.82	7.20
TOTAL	4,461	$181.86	260,500			
Average	371.7	15.16	21,708	179.4	1.71	6.98¢

* Brine circulating motor included.

Average temperature cooled milk, 41°F.

Average temperature of the box, 38°F.

Average pounds of milk cooled per day, 712.

Average time required for cooling per day, 2 hours and 30 minutes.

System of cooling: brine, with aerator and walk-in type box. Aerator capacity 50 gallons per hour.

Size box, 5x6x6 ft. Gallons of brine stored in box, 375. Storage space 130 cu. ft.

The compressor is an air cooled methyl chloride ½ ton unit.
Size of motors: compressor 1 hp.; aerator brine pump ¼ hp.

Mr. C. R. Birks' damaged windmill was replaced with an electric motor and pump jack. The motor is kept covered for protection from the weather.

JOE FREY

General Facts: Mr. Joe Frey's address is R. F. D. No. 1, Chickasha, Oklahoma. The farm is located 1 mile north and 1 mile west of Chickasha. It is a general farm of 450 acres; 330 acres of the land is owned by Mr. Frey and the other 120 acres leased. The farm income is derived from the sale of cattle, hogs, grain, hay and cotton, with the addition of some poultry and produce sales. The farm is managed and operated by Mr. Frey and family. The family at home consists of Mr. and Mrs. Frey, 4 sons and a daughter. Two or three hired men are kept during harvest and haying time, and the cotton is hired picked. The farm is supplied with electricity from a 13,200 volt primary line through a 5 kva. transformer. A 110-220 volt 3-wire service is run from the transformer to a 60 ampere entrance switch. The connected load consists of 1.18 kw. in lights and 7.2 kw. in equipment, a total of 8.38 kw. The wiring and fixtures for the farm were installed at a cost of around $75.

The Home: The residence is a two-story, nine-room wooden structure equipped with electric lights, running water, and sewage disposal system. It is heated during the winter months by a coal and wood stove. Electric conveniences used in the home other than lights are electric range, refrigerator, washing machine, radio, flat iron, and a pressure water system that supplies running water to the house from a storage tank in the cellar. The cost of this equipment when purchased was estimated to be $825.

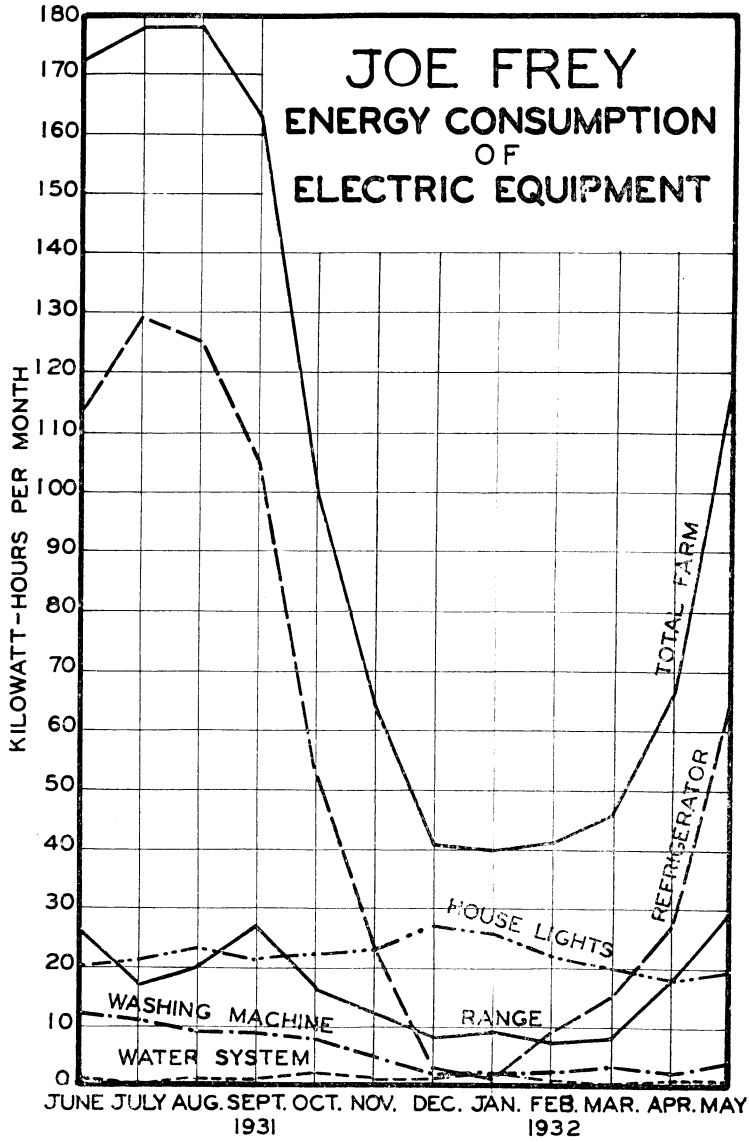
Farm Buildings: The improvements besides the house consists of general barn, hay barn, granary, hog house, poultry house, brooder house, wash house, and two-car garage. The garage and wash house are the only ones that are wired for lights and equipment.

Farm Equipment: No electric equipment is used for farming operations. Other power equipment on the farm consists of 2 tractors and a windmill. The tractors are used for driving threshing machine, feed grinder and hay baler in addition to field work. The windmill furnishes water for the stock, and fills the storage tank located in the cellar of the house.

Livestock and Poultry: An inventory of July 20, 1931, gave 45 head of cattle, 103 hogs, 4 horses, and 200 chickens. Some young cattle for feeding purposes, and some stock hogs, were purchased during the year. With the exception of this, most of the stock was raised on the farm.

Crops: The 1931 production was 40 acres of corn, 60 acres of wheat, 25 acres of oats, 25 acres of barley, 2 acres of kafir, 88 acres of alfalfa, 65 acres of cotton and 35 acres of tame pasture. Most of the feed grown was fed to stock on the farm, the remainder and the cotton were sold as a cash crop.

The kitchen of the Joe Frey home in which an electric refrigerator and a combination coal and electric range are used.


JOE FREY
ENERGY CONSUMPTION
OF
ELECTRIC EQUIPMENT
KILOWATT-HOURS PER MONTH
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
TOTAL FARM
REFRIGERATOR
HOUSE LIGHTS
WASHING MACHINE
RANGE
WATER SYSTEM
JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY
1931
1932

Joe Frey

Monthly Kilowatt-hour Consumption of Electric Equipment From May, 1931, to June, 1932.

Month	Total kw-hr.	Electric range	House refrig-erator	Washing machine	Water system	House lights
June	172	26	113	12	1	20
July	178	17	129	11	0*	21
August	178	20	125	9	1	23
September	163	27	105	9	1	21
October	100	16	52†	8	2	22
November	64	12	23†	5	1	23
December	41	8	3†	2	1	27
January	40	9	1†	2	2	26
February	41	7	9†	2	1	22
March	46	8	15†	3	0*	20
April	66	18	27†	2	1	18
May	117	29	64†	4	1	19
TOTAL	1206	197	666	69	12	262
Average	100.5	16.4	55.5	2.75‡	1	21.8

Monthly Energy Consumption Cost of Electric Equipment From May, 1931, to June, 1932.

Month	Total bill	Average cost per kw-hr.	Electric range	House refrig-erator	Washing machine	Water system	House lights
June	$12.16	7.07¢	$1.84	$7.99	$0.85	$0.07	$1.41
July	12.34	6.93	1.18	8.94	0.76	0*	1.46
August	12.34	6.93	1.39	8.67	0.62	0.07	1.59
September	11.89	7.29	1.97	7.66	0.66	0.07	1.53
October	10.00	10.00	1.60	5.20†	0.80	0.20	2.20
November	8.92	13.94	1.67	3.21†	0.70	0.14	3.20
December	7.87	19.20	1.54	0.58†	0.38	0.19	5.18
January	7.80	19.50	1.76	0.19†	0.39	0.39	5.07
February	7.87	19.20	1.34	1.73†	0.38	0.19	4.23
March	8.22	17.87	1.43	2.68†	0.54	0*	3.57
April	8.98	13.61	2.45	3.67†	0.27	0.14	2.45
May	10.51	8.98	2.60	5.75†	0.36	0.09	1.71
TOTAL	$118.90		$20.77	$56.27	$6.71	$1.55	$33.60
Average	9.91	9.86¢	1.73	4.69	0.32‡	0.13	2.80

* Consumption less than 1 kilowatt-hour.

† The refrigerator was not turned on except when needed.

‡ See footnote under washing machine records.

Connected load in kilowatts: lights 1.18, equipment 7.2, total 8.38.

The water system furnished water from a storage tank for the house use of 8 people. The water is supplied by a windmill to the storage tank, located in the cellar of the house.

The house lights include wash-house lights, garage lights, yard lights and radio.

The range is a combination coal and electric. The electric part consists of 2 plates and an oven, and has a connected load of 5750 watts. It is only used for an occasional meal and for baking during hot weather. In the late fall, winter and early spring the electric iron is used off the

range convenience outlet. During December, January, February and March the energy used was for the iron alone. The ironing done during this time was for 8 people. The consumption per person per month was 1 kilowatt-hour.

The refrigerator has a capacity of 9 cu. ft.

Joe Frey

Washing Machine Record From May, 1931, to June, 1932.

Month	Kw-hr.	Cost	Machines of dry clothes	Kw-hr. per 10 machines	Cost per 10 machines
June	12*	$0.85*	24	1.67	11.7¢
July	11*	0.76*	22	1.36	9.5
August	9*	0.62*	18	1.67	11.7
September	9*	0.66*	23	1.30	9.6
October	8*	0.80*	27	1.48	14.8
November	5*	0.70*	20	1.50	21.0
December	2	0.38	13	1.54	29.2
January	2	0.39	14	1.43	27.9
February	2	0.38	14	1.43	27.1
March	3	0.54	17	1.76	31.8
April	2	0.27	16	1.25	16.9
May	4*	0.36*	17	1.18	10.6
TOTAL	69	$6.71	225		
Average	2.75*	0.32*	18.75	1.47	17.2¢

* The electric iron was used on the washing machine meter for an estimate of 8 kw-hr. in June, 8 kw-hr. in July, 6 kw-hr. in August, 6 kw-hr. in September, 4 kw-hr. in October, 2 kw-hr. in November and 2 kw-hr. in May; this consumption was subtracted in computing unit and average values for washing.

The washing was done for 8 people. A six sheet capacity, vacuum type machine equipped with power wringer and driven by a ¼ hp. motor was used. Average time required per month for washing, 18 hours.

Average kilowatt-hours required per person per month, 0.34.

Average cost per person per month, 4 cents.

Average kilowatt-hours required per 100 lbs. clothes washed, 1.75

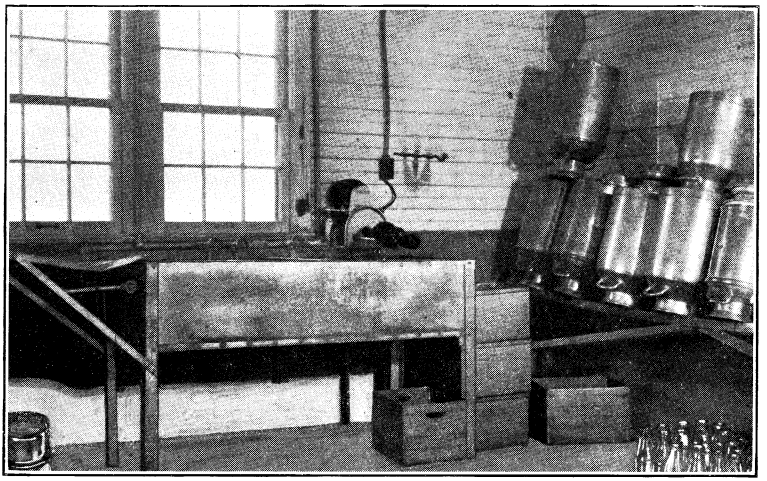
Average cost per 100 lbs. of clothes washed, 20.6 cents.

E. K. GAYLORD—DAIRY

General Facts: Mr. E. K. Gaylord's address is Oklahoma City, Oklahoma. The farm is located 4 miles west and 1½ miles north of Britton, Oklahoma. It is a dairy farm with 800 acres of land, 640 acres of which is owned by Mr. Gaylord, while the other 160 acres is rented. The farm income is derived from the sale of milk, surplus dairy cattle, sheep and hogs. About 47 head of cows are milked and the milk retailed to customers in Oklahoma City. The farm is in charge of Mr. T. H. Hayton who is employed by Mr. Gaylord to supervise the farm operation. In addition to Mr. Hayton, 8 hired men are kept the year round and extra help hired during the rush season The farm is supplied electricity from a 4000 volt primary line through a 7½ kva. transformer. A 110-220 volt 3-wire service is run from the transformer to a 200 ampere entrance switch. The connected load consists of 4.26 kw. in lights and 15.33 kw. in equipment, a total of 19.59 kw. The wiring and fixtures for the farm were installed at an estimated cost of $2,000.

The Home: The farm dwelling is the residence of Mr. Hayton; it is an eight-room, two-story wooden structure equipped with lights, running

water, sewage disposal system, and a hot air coal burning furnace. Conveniences used in the home other than lights are refrigerator, vacuum cleaner, radio, flat iron, toaster, and hot plate. The cost of this equipment when purchased was estimated to be $650.



The three-brush bottle washer used at Mr. E. K. Gaylord's dairy. This machine was operated at a cost of 1.38 cents per 1000 bottles washed.

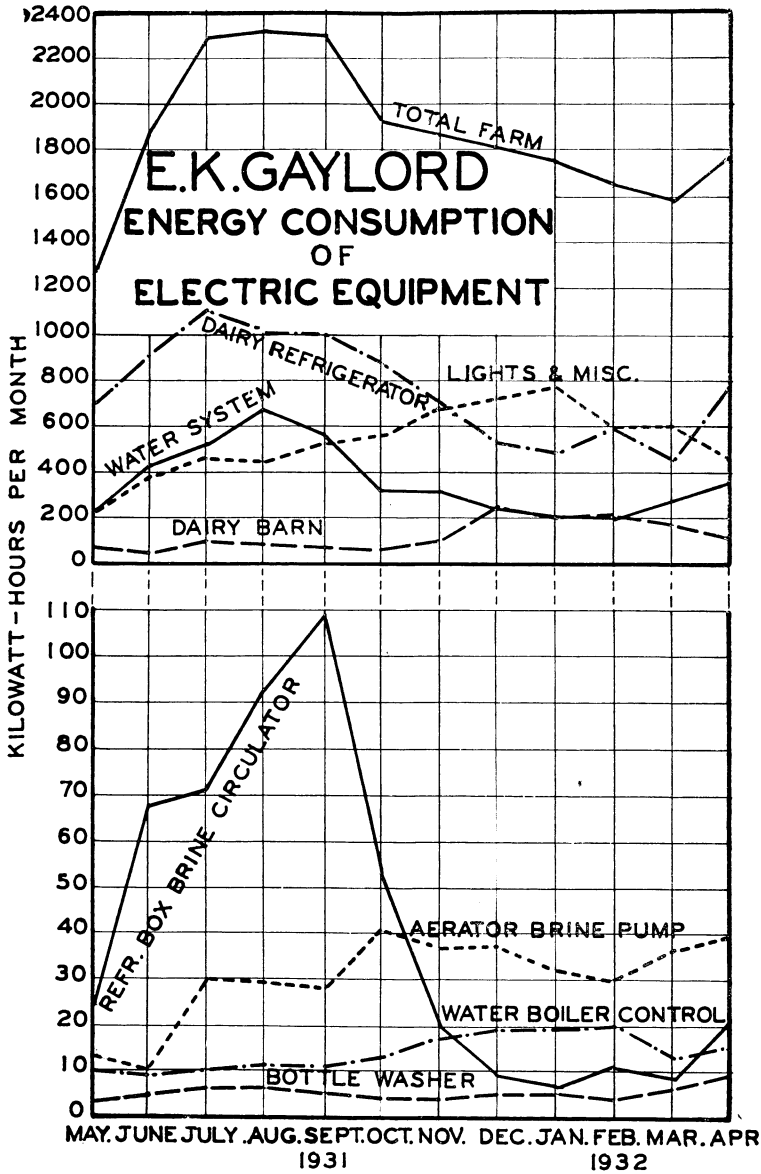
Tenant Houses: Five tenant houses are located on the farm for residences of the hired men and families. These houses are wooden structures equipped with lights and running water. Three of them have 3 rooms and 2 of them have 2 rooms. The conveniences used in these houses other than lights are 4 flat irons, radio and hot plate.

Farm Buildings: The farm improvements, other than houses, consist of dairy barn, test barn, calf barn, hospital barn, horse barn, hog house, poultry house, milk house, silo, feed house and granary, machine shed and garage. All of the buildings are wired for lights and equipment, and most of them are supplied with running water.

Farm Equipment: A large water system with pressure tank supplies running water to all of the houses, and to most of the farm buildings. A small water system with elevated tank is used for standby service. In the milk house a refrigerator, brine circulator, bottle washer, cream separator, and an oil fired, automatic temperature controlled water boiler are used to save time, and produce a high quality of milk. In the dairy barn are temperature controlled ventilating fans and insect electrocutors. The cost of this equipment when purchased was estimated to be $3,250. In addition to the electric equipment, tractors and trucks are used on the farm as a source of power.

Livestock and Poultry: An inventory of June 2, 1932, gave 145 head of cattle, 6 horses, 200 hogs, 112 sheep, and 350 chickens.

Crops: The 1931 production was 14 acres of corn, 100 acres of wheat, 75 acres of oats, 50 acres of tame pasture, 200 acres of wild pasture, 50 acres of alfalfa, 14 acres of prairie hay, 75 acres of sweet clover and 25 acres of cowpeas. The feed grown was fed to stock on the farm. In addition to crops grown, considerable hay, oats, corn, cottonseed meal, and bran were purchased for feed.


E.K.GAYLORD
ENERGY CONSUMPTION
OF
ELECTRIC EQUIPMENT
KILOWATT-HOURS PER MONTH
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
TOTAL FARM
DAIRY REFRIGERATOR
LIGHTS & MISC.
WATER SYSTEM
DAIRY BARN
110
100
90
80
70
60
50
40
30
20
10
0
REFR. BOX BRINE CIRCULATOR
AERATOR BRINE PUMP
WATER BOILER CONTROL
BOTTLE WASHER
MAY. JUNE JULY .AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.
1931
1932

E. K. Gaylord

Monthly Kilowatt-hour Consumption of Electric Equipment From April, 1931, to May, 1932.

Month	Total kw-hr.	Dairy refrig-erator*	Aerator brine pump	Refrigerator box brine circulator	Water system	Bottle washer	Water boiler fuel control	Dairy barn	Lights and misc.
May	1,284	698	13	24	232	3	10	74	230
June	1,873	914	10	68	433	5	9	50	384
July	2,306	1,101	30	71	526	6	10	102	460
August	2,342	995	29	93	674	6	11	89	445
September	2,302	999	28	109	552	5	11	77	521
October	1,926	871	41	53	320	4	13	66	558
November	1,866	699	37	20	308	4	17	101	680
December	1,814	543	37	9	237	5	19	244	720
January	1,756	491	32	6	212	5	19	205	786
February	1,658	593	30	11	198	4	20	213	589
March	1,577	454	36	8	283	6	13	176	601
April	1,771	768	39	20	348	9	15	117	455
TOTAL	22,475	9,126	362	492	4,323	62	167	1,514	6,429
Average	1,873	761	30	41	360	5	14	126	536

E. K. Gaylord

Monthly Energy Consumption Cost of Electric Equipment From April, 1931, to May, 1932.

Month	Total bill	Average cost per kw-hr.	Dairy refrig-erator*	Aerator brine pump	Refr. box brine circulator	Water system	Bottle washer	Water boiler fuel control	Dairy barn	Lights and misc.
May	$81.86	6.38¢	$44.50	$0.83	$ 1.53	$14.79	$0.19	$0.64	$4.72	$14.66
June	100.41	5.36	49.00	0.54	3.65	23.21	0.27	0.48	2.68	20.58
July	114.05	4.95	54.46	1.48	3.51	26.01	0.30	0.50	5.04	22.75
August	115.27	4.92	48.97	1.43	4.58	33.17	0.03	0.54	4.38	21.90
September	113.92	4.95	49.44	1.39	5.39	27.32	0.25	0.54	3.81	25.78
October	102.08	5.30	46.16	2.17	2.81	16.96	0.21	0.69	3.50	29.58
November	100.19	5.37	37.53	1.99	1.07	16.54	0.22	0.91	5.42	36.51
December	98.55	5.43	29.50	2.01	0.49	12.88	0.27	1.03	13.26	39.11
Jauuary	96.72	5.51	27.04	1.76	0.33	11.68	0.28	1.05	11.29	43.29
February	93.60	5.65	33.48	1.69	0.62	11.18	0.23	1.13	12.02	33.25
March	91.09	5.78	26.22	2.08	0.46	16.35	0.35	0.75	10.17	34.71
April	97.19	5.49	42.15	2.14	1.10	19.10	0.49	0.82	6.42	24.97
Total	$1204.93		$488.45	$19.51	$25.54	$229.19	$3.36	$9.08	$82.71	$347.09
Average	100.41	5.36¢	40.70	1.63	2.13	19.10	0.28	0.76	6.89	28.92

* This meter was burned out by lightning before the final calibration was made.

Connected load in kilowatts: lights 4.26, equipment 15.33, total 19.59.

The water system furnishes water from a 435-foot well for an average of 17 people, 7 horses, 93 head of cattle, 96 hogs, 40 sheep, 300 chickens; water for washing out milk house and dairy barn; and water for some garden irrigation.

The boiler fuel control consists of a ⅛ horsepower motor and relays for the automatic temperature regulation of an oil-fired water heater for the dairy.

The dairy barn equipment consists of lights, four large temperature controlled ventilating fans and insect electrocutor screens.

"Lights and misc." include lights for six houses, test barn, hospital barn, calf barn, horse barn, hog house, machine shed and garage, milk house, and chicken house; house refrigerator, vacuum cleaner, five flat irons, two radios, two hot plates, toaster, cream separator and a standby water pump.

E. K. Gaylord

Bottle Washer Record From April, 1931, to May, 1932.

Month	Total kw-hr.	Total cost	Number bottles washed	Kw-hr. per 1000 bottles	Cost per 1000 bottles
May	3	$0.19	10,850	0.28	1.75¢
June	5	0.27	21,900	0.23	1.23
July	6	0.30	26,350	0.23	1.14
August	6	0.30	20,150	0.30	1.49
September	5	0.25	19,500	0.26	1.28
October	4	0.21	20,150	0.20	1.04
November	4	0.22	19,500	0.21	1.13
December	5	0.27	19,200	0.26	1.41
January	5	0.28	19,850	0.25	1.41
February	4	0.23	18,850	0.21	1.22
March	6	0.35	17,050	0.35	2.05
April	9	0.49	29,300	0.31	1.67
TOTAL	62	$3.36	242,650		
Average	5	0.28	20,220	0.25	1.38¢

Average number of bottles washed per day, 663.

Average time required for washing per day, 1 hr. 45 min.

The bottle washer consists of three rotating brushes, which wash two bottles at a time and are driven by a ¼ horsepower motor.

Dairy Refrigerator Record From April, 1931, to May, 1932.

Month	Total* kw-hr.	Total* cost	Pounds of milk cooled	Average lbs. in storage continuously	Kw-hr. per 100 pounds cooled	Cost per 100 pounds cooled	Pounds ice frozen
May	735	$46.86	12,300	70	5.98	38.1¢	3,400
June	992	53.19	16,100	160	6.16	33.0	6,000
July	1,202	59.45	24,000	198	5.01	24.8	6,200
August	1,117	54.98	20,500	95	5.45	26.8	6,200
September	1,136	56.22	19,900	75	5.71	28.3	6,000
October	965	51.14	20,500	115	4.71	24.9	6,200
November	756	40.59	20,100	130	3.76	20.2	6,000
December	589	32.00	22,700	235	2.59	14.1	4,650
January	529	29.13	19,500	120	2.71	14.9	3,100
February	634	35.79	19,200	275	3.30	18.6	4,350
March	498	28.76	18,400	260	2.71	15.6	4,650
April	827	45.39	23,200	210	3.56	19.6	1,200†
TOTAL	9,980	$533.50	236,400				57,950
Average	832	44.46	19,700	162	4.22**	22.6¢**	5,140†

* Aerator brine pump and refrigerator box circulator included.

† No ice was frozen after the first eight days of April; this was taken into account in computing the ice average.

** An average of 25 pounds of ice was frozen for each 100 pounds of milk cooled.

Milk cooled to average temperature of 38°F.

Average temperature of refrigerator cold room, 38°F.

Average pounds of milk cooled per day, 646.
Average time required for cooling milk per day, 1 hr. and 20 min.
Brine circulated through an aerator is used for cooling milk. Capacity of aerator, 50 gals. per hour.
The brine is stored in an insulated tank outside the cold room. Eight 50-pound cans are set in the tank for the freezing of 200 pounds of ice per 24 hours. Gallons of brine, 300.
The cold room temperature is maintained by brine, circulated through refrigerating coils in the room. Size of room 5x6x6 ft.
Brine tank and cold room temperatures are automatically controlled by thermostats that operate on the refrigerator and brine circulator motors.
The compressor is a one-ton, methyl chloride, air- and water-cooled unit, driven by a 1½ horsepower motor.
Brine circulators consist of pump and ¼ horsepower motor.

J. W. HENDERSON—DAIRY

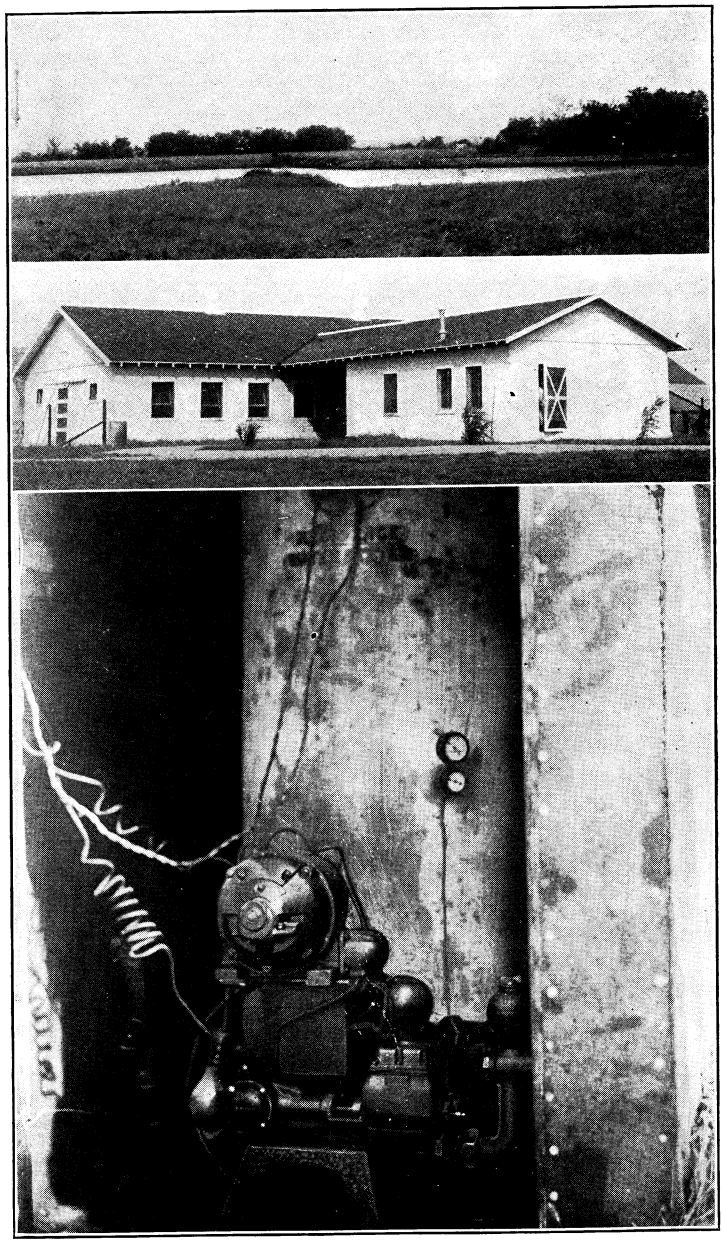
General Facts: Mr. J. W. Henderson's address is R. F. D. No. 1, Owasso, Oklahoma. The farm is located ½ mile north and ½ mile east of Owasso. It is a dairy farm with 560 acres of land, most of which is kept in pasture. Of the land, 240 acres are owned by Mr. Henderson and the other 320 acres are leased by him. The farm income is derived from the sale of milk and surplus dairy cattle. An average of about 58 cows were milked throughout the year and the milk sold at wholesale in Tulsa, Oklahoma. The farm is managed and operated by Mr. and Mrs. Henderson. Three hired men are kept the year round and additional help hired when needed. The farm is supplied electric service from a 2300 volt primary line through a 5 kva. transformer. A 110-220 volt 3-wire service is run from the transformer to a 30 ampere entrance switch. The connected load consists of 1.8 kw. in lights and 5.96 kw. in equipment, a total of 7.76 kw. The wiring for the farm was installed at a cost of around $200.

The Home: The residence is a three-room wooden structure equipped with electric lights, running water, bath, kitchen sink and natural gas heat. Electric conveniences used in the home other than lights are refrigerator, radio, flat iron, toaster, waffle iron and 3 portable fans. The cost of this equipment when purchased was estimated to be $550.

Tenant Houses: Two houses are located on the farm in addition to the home residence. These are three-room wooden structures equipped with electric lights and natural gas heat. They are used as the residences of the hired men and their families. An electric flat iron is used in each house as an additional convenience.

Farm Buildings: The improvements other than residences consist of dairy barn, milk house, cattle shed, calf barn, calf shed, horse barn, feed house, hay barn, poultry house, and garage. These buildings are all wired for lights and equipment. The milk house is supplied with running water and natural gas in addition to lights.

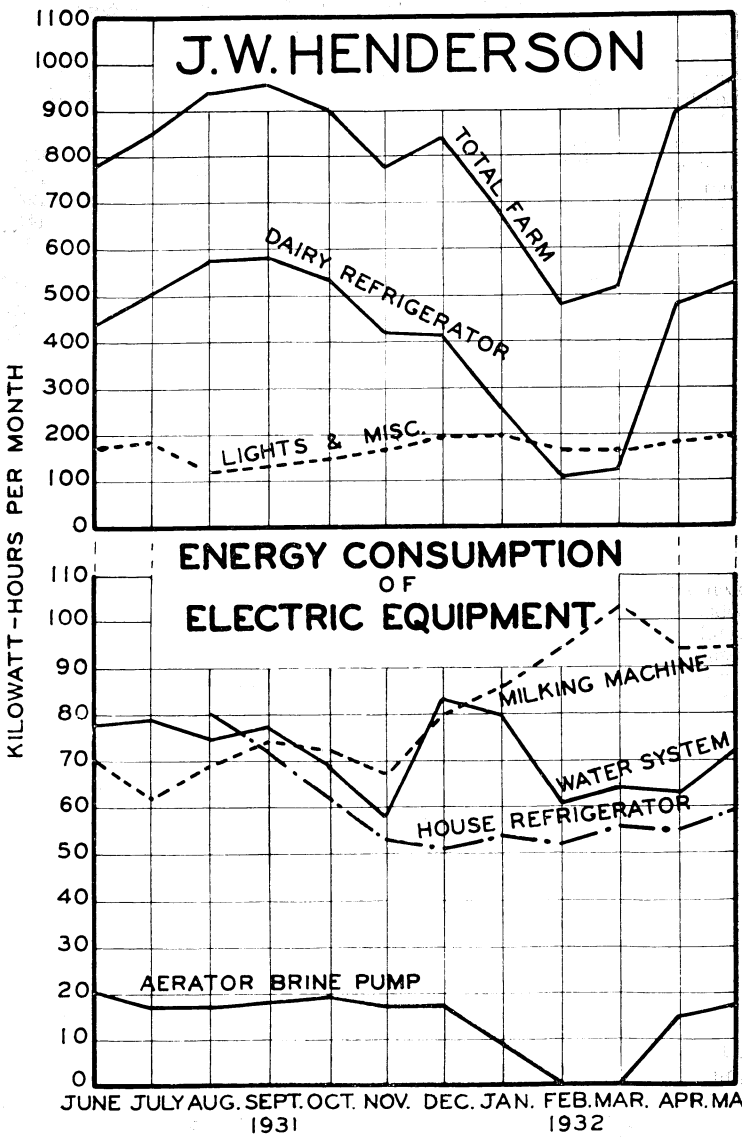
Farm Equipment: Electric equipment used on the farm outside the home consists of dairy refrigerator, aerator brine pump, milking machine, cream separator, insect electrocutor screens, and pressure water system. The water system supplies running water to the house, milk house, and barn lots, from a farm pond. The cost of this equipment when purchased was estimated to be $2360. Other power equipment used on the farm consists of tractor and farm truck. The tractor is used for feed grinding in addition to field work.



Mr. J. W. Henderson has solved his dairy water problem by constructing the farm pond and using the automatic water system shown.

Livestock and Poultry: An inventory of October 16, 1931, gave 120 head of cattle, 3 horses and 50 chickens.

Crops: The 1931 production was 100 acres of tame pasture, and 440 acres of wild pasture and hay. All of the feed grown was consumed by stock on the farm. In addition to the feed grown considerable grain, dairy feed, and hay were purchased throughout the year for feed.



J. W. Henderson—Dairy

Monthly Kilowatt-hour Consumption of Electric Equipment From May, 1931, to June, 1932.

Month	Total kw-hr.	Dairy refrig-erator*	Aerator brine pump	Milking machine	Water system	House refrig-erator	Lights and misc.
June	778	438	20	70	78		172†
July	848	505	17	62	79		185†
August	939	578	17	69	75	80	120
September	954	585	18	74	77	72	128
October	903	534	19	72	69	62	147
November	780	418	17	67	58	53	167
December	840	411	17	80	83	51	198
January	680	254	9	86	80	54	197
February	480	109	0	94	61	52	164
March	516	127	0	103	64	56	166
April	893	483	15	94	63	55	183
May	961	525	17	94	72	59	194
TOTAL	9572	4967	166	965	859	594	2021
Average	798	414	16.6	80.4	71.6	59.4	168.4

Monthly Energy Consumption Cost of Electric Equipment From May, 1931, to June, 1932.

Month	Total bill	Average cost per kw-hr.	Dairy refrig-erator*	Aerator brine pump	Milking machine	Water system	House refrig-erator	Lights and misc.
June	$28.34	3.64¢	$15.96	$0.73	$2.55	$2.84		$6.26†
July	30.44	3.59	18.13	0.61	2.22	2.84		6.64†
August	33.17	3.53	20.41	0.60	2.44	2.65	$2.83	4.24
September	33.62	3.52	20.62	0.63	2.61	2.71	2.54	4.51
October	32.09	3.55	18.98	0.68	2.56	2.45	2.20	5.22
November	28.40	3.64	15.22	0.62	2.44	2.11	1.93	6.08
December	30.20	3.60	14.78	0.61	2.88	2.98	1.83	7.12
January	25.40	3.74	9.49	0.34	3.21	2.99	2.01	7.36
February	19.40	4.04	4.41		3.80	2.46	2.10	6.63
March	20.48	3.97	5.04		4.09	2.54	2.22	6.59
April	31.79	3.56	17.20	0.53	3.35	2.24	1.96	6.51
May	33.83	3.52	18.48	0.60	3.31	2.53	2.08	6.83
TOTAL	$347.16		$178.72	$5.95	$35.46	$31.34	$21.70	$73.99
Average	28.93	3.63¢	14.89	0.60	2.96	2.61	2.17	6.17

* The meter on final calibration was found in error greater than the allowable limit; this was compensated for in the data given.

† House refrigerator included.

Connected load in kilowatts: lights 1.8, equipment 5.96, total 7.76.

The water system furnishes water from a farm pond for an average of 7 people, 3 horses, 116 head of cattle, 6 hogs, and 65 chickens, and in addition water for washing out dairy barns and milk house and for cooling the dairy refrigerator compressor.

The house refrigerator has a capacity of 9 cubic feet.

"Lights and miscellaneous" include the lights of 3 houses, horse barn, dairy barn, milk house, cattle shed, calf barn, calf shed, feed house, poultry house and garage, and the consumption of 3 flat irons, radio, toaster and waffle iron.

J. W. Henderson—Dairy

Milking Machine Record From May, 1931, to June, 1932.

Month	Kw-hr.	Cost	Total pounds milk	Kw-hr. per 1000 pounds milk	Number of cows	Kw-hr. per cow per month	Cost per cow per month
June	70	$2.55	34,908	2.01	53	1.32	4.81¢
July	62	2.22	31,533	1.97	48	1.29	4.63
August	69	2.44	34,768	1.98	55	1.25	4.44
September	74	2.61	41,236	1.79	57	1.30	4.58
October	72	2.56	43,974	1.64	52	1.39	4.92
November	67	2.44	35,940	1.86	52	1.29	4.69
December	80	2.88	43,777	1.83	56	1.43	5.14
January	86	3.21	45,821	1.88	61	1.41	5.26
February	94	3.80	46,954	2.00	68	1.38	5.59
March	103	4.09	51,598	2.00	67	1.54	6.10
April	94	3.35	48,925	1.92	61	1.54	5.49
May	94	3.31	43,470	2.16	60	1.57	5.52
TOTAL	965	$35.46	502,904				
Average	80.4	2.96	41,909	1.92	57.5	1.40	5.14¢

Average cost per 1000 pounds of milk, 7.05 cents.

Average time required per day for milking, 4 hours.

The milking machine is a 3-unit, of the pipe-line type, equipped with vacuum pulsator and driven by a ½ hp. motor.

Dairy Refrigerator Record From May, 1931, to June, 1932.

Month	Total kw-hr.*	Total cost*	Pounds of milk cooled	Avearge pounds in storage continuously	**Kw-hr.** per 100 pounds cooled	Cost per 100 pounds cooled
June	458	$16.69	29,677	218	1.54	5.62¢
July	522	18.74	26,302	210	1.98	7.12
August	595	21.01	29,537	216	2.01	7.11
September	603	21.25	36,005	258	1.67	5.90
October	553	19.66	38,743	300	1.43	5.07
November	435	15.84	30,709	290	1.42	5.16
December	428	15.39	38,546	332	1.11	3.99
January	263†	9.83†	13,320†	380	1.11	4.13
February	109‡	4.41‡	‡	436	‡	‡
March	127‡	5.04‡	‡	400	‡	‡
April	498†	17.73†	37,900†	400	1.26	4.49
May	542	19.08	38,239	432	1.42	4.99
TOTAL	5,133	$184.67	323,978			
Average	428	15.39	34.724§	326	1.49£	5.32¢£

* Aerator brine pump included.

† Brine was used to cool milk 14 days in January and 26 days in April. It is estimated that 60 kilowatt-hours in January and 20 kilowatt-hours in April were used to provide cold storage while the milk was not being cooled; these values were subtracted in computing unit consumptions.

‡ The milk was cooled with pond water, and stored in the refrigerator.

§ Based on 9.33 months.

£ 316 kilowatt-hour, used during January, February, March and April to provide cold storage, was subtracted from the total in computing unit average values.

Average temperature of cooled milk, 39°F.

Average temperature of box, 37°F.

Average pounds of milk cooled per day, 1137.

Average time required per day for cooling, 3 hours and 20 minutes.

System of cooling: brine, with aerator and walk-in type box. Aerator capacity, 50 gallons per hour.

Size of box, 5x7x7 feet. Gallons of brine stored in box, 335. Storage space, 190 cu. ft.

The compressor is a water cooled, sulphur dioxide, ½-ton unit and is driven by a one horse power motor.

The aerator brine circulator consists of a rotary pump direct connected to a ¼ horsepower motor.

JOHN HUDMAN—DAIRY

General Facts: Mr. John Hudman's address is R. F. D. No. 1, Britton, Oklahoma. The farm is located 2 miles east and ¾ mile south of Britton. The land is owned by Mr. J. R. Phelan, and was leased to Mr. A. I. Rice for dairy purposes. During January, 1932, Mr. Rice sold his dairy interest to Mr. Hudman. From January 20 on, the dairy was managed and operated by Mr. Hudman. The land consists of 200 acres most of which was kept in pasture. The income from the farm was derived from the sale of milk, surplus dairy cattle, and hogs. An average of 30 cows were milked during the year, and the milk retailed to customers in Oklahoma City. Two hired men are kept the year round and extra help hired during rush seasons. The farm is served both single- and three-phase electricity from a 4000 volt primary line through two 3 kva. and one 5 kva. transformers. A 3-wire 220 volt, 3-phase service is run from the transformers to a 60 ampere entrance switch for power, and a 2-wire 110 volt service is run to a 30 ampere entrance switch for lights. The connected load is 0.9 kw. of lights and 11.1 kw. of equipment, a total of 12 kw. The cost of fixtures and wiring for the farm was estimated to be $250.

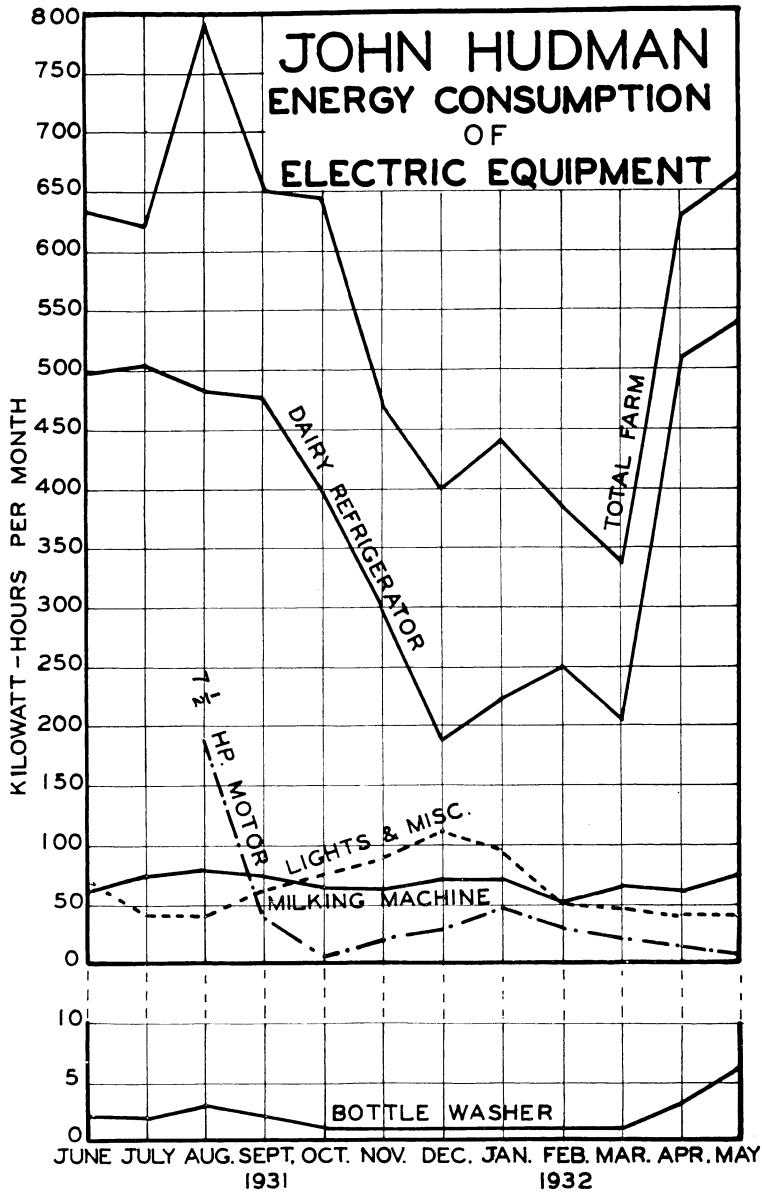
The Home: The residence is a two-story wooden structure with eight rooms and bath. It is equipped with lights, running water, sewage disposal system, and is heated by an oil-fired hot air furnace. The convenience used other than lights was an electric flat iron, the cost of which was estimated to be $6.

Farm Buildings: The improvements in addition to the house are dairy barn, milk house, cow shed, horse barn, poultry house, garage and silo. The garage, dairy barn and milk house are the only ones of these that are wired for lights and power. An elevated tank supplies running water to the house, milk house, and barn lots.

Farm Equipment: Electric equipment used in the dairy is milking machine, dairy refrigerator, brine circulating pump, and bottle washer. A 7½ horsepower motor was used to drive the feed grinder and ensilage cutter. In the shop an emery wheel, circular saw and drill were used. The cost of the equipment when purchased was estimated to be $2,000. A tractor, motor truck, 1½ horsepower gasoline engine, and windmill are used as other sources of power on the farm.

Livestock: An inventory of June 1, 1932, gave 52 head of cattle, 97 hogs and 3 horses.

Crops: Crops in the ground June 1, 1932, were 25 acres of corn, 30 acres of oats, 15 acres of tame pasture, and 110 acres of wild pasture. The crop production of Mr. Rice for 1931 from the farm and from additional land was 70 acres of corn, 60 acres of cane, 20 acres of Sudan and 125 acres of wild pasture. All of the feed grown was fed to stock on the farm. Some dairy feed was purchased in addition to that grown.


JOHN HUDMAN
ENERGY CONSUMPTION
OF
ELECTRIC EQUIPMENT
KILOWATT-HOURS PER MONTH
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
10
5
0
DAIRY REFRIGERATOR
TOTAL FARM
1½ HP. MOTOR
LIGHTS & MISC.
MILKING MACHINE
BOTTLE WASHER
JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY
1931
1932

John Hudman—Dairy

Monthly Kilowatt-hour Consumption of Electric Equipment
From May, 1931, to June, 1932.

Month	Total kw-hr.	Dairy refrig-erator	Milking machine	7½ hp. motor	Bottle washer	Lights and misc.
June	633	498	64		2	69†
July	621	504	74		2	41†
August	793	482	79	189	3	40
September	650	474	74	38	2	62
October	543	398	65	6	1	73
November	470	298	63	20	1	88
December	399	187	72	28	1	111
January	439	223	71	47	1	97
February	384	250	52*	30	1	51
March	337	204	65	21	1	46
April	628	509	61	14	3	41
May	661	537	73	6	6	39
TOTAL	6558	4564	813	399	24	758
Average	547	380	70	40‡	2	63

Monthly Energy Consumption Cost of Electric Equipment
From May, 1931, to June, 1932.

Month	Total bill	Average cost per kw-hr.	Dairy refrig-erator	Milking machine	7½ hp. motor	Bottle washer	Lights and misc.
June	$27.31	4.31¢	$21.48	$2.76		$0.09	$2.98†
July	26.89	4.33	21.82	3.20		0.09	1.78†
August	33.15	4.18	20.15	3.30	$7.90	0.13	1.67
September	27.81	4.28	20.28	3.17	1.62	0.09	2.65
October	23.71	4.37	17.38	2.84	0.26	0.04	3.19
November	20.60	4.38	13.06	2.76	0.88	0.04	3.86
December	17.48	4.38	8.19	3.16	1.23	0.04	4.86
January	19.25	4.39	9.79	3.11	2.06	0.04	4.25
February	17.51	4.56	11.40	2.37*	1.37	0.04	2.33
March	15.66	4.65	9.48	3.02	0.98	0.04	2.14
April	27.13	4.32	21.99	2.64	0.60	0.13	1.77
May	28.33	4.29	23.01	3.13	0.26	0.26	1.67
TOTAL	$284.83		$198.03	$35.46	$17.16	$1.03	$33.15
Average	23.73	4.34¢	16.50	3.04	1.72‡	0.09	2.76

* The milking machine was used only 19 days during the month; this was compensated for in computing the monthly average.

† 7½ hp. motor included.

‡ Average over 10 months.

Connected load in kilowatts: lights 0.9, equipment 11.1, total 12.

"Lights and misc." include house lights, dairy barn lights, milk house lights, yard lights, cream separator, shop motor, electric iron and automatic furnace draft.

John Hudman—Dairy
Dairy Refrigerator Record From May, 1931, to June, 1932.

Month	Kw-hr.	Cost	Pounds of milk cooled	Average pounds in storage continuously	Kw-hr. per 100 pounds cooled	Cost per 100 pounds cooled
June	498	$21.48	16,860	415	2.95	12.74¢
July	504	21.82	18,130	220	2.79	12.04
August	482	20.15	17,960	205	2.68	11.22
September	474	20.28	16,650	200	2.85	12.18
October	398	17.38	16,000	195	2.49	10.86
November	298	13.06	13,970	110	2.13	9.35
December	187	8.19	12,790	97	1.46	6.40
January	223	9.79	12,980	97	1.72	7.54
February	250	11.40	18,700	160	1.35	6.10
March	204	9.48	21,350	172	0.96	4.44
April	509	21.99	21,300	178	2.39	10.32
May	537	23.01	22,100	190	2.43	10.41
TOTAL	4,564	$198.03	208,790			
Average	380	16.50	17,399	187	2.19	9.48¢

Average temperature of cooled milk, 36°F.

Average temperature of refrigerator box, 36°F.

Average pounds of milk cooled per day, 570.

Average time required for cooling per day, 1 hr. and 30 min.

System of cooling: brine, with aerator and walk-in type box. Aerator capacity 50 gallons per hr.

Size of box, 5x6x6 feet. Gallons of brine stored in box, 375. Storage space, 130 cu. ft.

The refrigerator compressor is an air-cooled, methyl-chloride, ½ ton unit, and is driven by a 1 horsepower motor.

Brine is circulated through the aerator by a centrifugal pump, driven by a ¼ horsepower motor.

Bottle Washer Record From May, 1931, to June, 1932.

Month	Kw-hr.	Cost	Bottles washed	Kw-hr. per 1000 bottles	Cost per 1000 bottles
June	2	$0.09	7,050	0.28	1.28¢
July	2	0.09	8,350	0.24	1.08
August	3	0.13	8,660	0.35	1.50
September	2	0.09	6,000	0.33	1.50
October	1	0.04	7,400	0.14	0.54
November	1	0.04	7,500	0.13	0.53
December	1	0.04	6,000	0.17	0.67
January	1	0.04	6,800	0.15	0.59
February	1	0.04	8,700	0.11	0.46
March	1	0.04	9,300	0.11	0.43
April	3	0.13	10,500	0.29	1.24
May	6	0.26	12,400	0.48	2.10
TOTAL	24	$1.03	98,660		
Average	2	0.09	8,222	0.24	1.04¢

Average number of bottles washed per day, 270.

Average time required for washing, 40 min.

The bottle washer has one rotating brush and is driven by a ¼ horsepower motor.

John Hudman—Dairy

Milking Machine Record From May, 1931, to June, 1932.

Month	Total kw-hr.	Total cost	Total pounds milk	Kw-hr. per 1000 pounds milk	Number cows	Kw-hr. per cow per mo.	Cost per cow per mo.
June	64	$2.76	16,860	3.80	30	2.13	9.2
July	74	3.20	18,130	4.08	30	2.47	10.7
August	79	3.30	17,960	4.40	34.5	2.29	9.6
September	74	3.17	16,650	4.44	29	2.55	10.9
October	65	2.84	16,000	4.06	27	2.41	10.5
November	63	2.76	13,970	4.51	26.6	2.37	10.4
December	72	3.16	12,790	5.63	28	2.57	11.3
January	71	3.11	12,980	5.47	28	2.54	11.1
February*	52*	2.37*	21,250*	4.24*	35*	2.27	10.4
March	65	3.02	21,350	3.04	30	2.17	10.1
April	61	2.64	21,300	2.86	26	2.35	10.2
May	73	3.13	21,350	3.42	30	2.43	10.4
TOTAL	813	$35.46	201,590				
Average	70	3.04	17,296	4.03	29.5	2.37	10.3¢

* The milking machine was used only 19 days during the month; this was compensated for in computing average and unit values.

Average cost per 1000 pounds of milk, 17.6¢.

Average time required per day for milking, 1 hr. and 50 min.

The milking machine is a 4-unit, of the pipe line type, with magnetic pulsator. It is driven by a 1 hp. motor.

7½ Horsepower Motor Record of Feed Grinding and Ensilage Cutting From July, 1931, to June, 1932.

Month	Total kw-hr.	Total cost	POUNDS OF FEED GROUND				Kw-hr. per 100 pounds	Cost per 100 pounds
			Oats	Wheat	Head kafir	Total		
August	189**	$7.90**	2,200			2,200	0.82	3.41¢
September	38	1.62	4,110	1,400		5,510	0.69	2.94
October	6	0.26	400	300		700	0.86	3.71
November	20	0.88			3,530	3,530	0.57	2.49
December	28	1.23			4,350	4,350	0.64	2.83
January	47	2.06	1,350		3,100	4,450	1.06	4.63
February	30	1.37	2,910			3,310*	0.91	4.14
March	21	0.98	3,100			3,100	0.68	3.16
April	14	0.60	2,000			2,000	0.70	3.00
May	6	0.26	960			960	0.63	2.71
TOTAL	399	$17.16	17,030	1,700	10,980	30,110		
Average	40	1.72	1,703	170	1,098	3,011	0.76	3.32¢

* 400 pounds of straw included.

** 171 kilowatt-hours were used for ensilage cutting at a total cost of $7.15, 105 tons of corn and cane silage were cut to ½ inch length and elevated into a 35 foot silo. The total time required for cutting was

30 hours; an average of 3.5 tons per hour. The average consumption per ton was 1.63 kilowatt-hours, costing 6.8 cents.

Pounds of grain ground per hour, 860.

The grain is ground medium fine, as an average.

The mill is of the rigid-hammer type and is operated without elevator and dust collector.

D. C. HYBARGER

General Facts: Mr. D. C. Hybarger's address is R. F. D. No. 4, Chickasha, Oklahoma. The farm is located 3½ miles east of Chickasha. It is a general stock farm of 140 acres most of which is kept in pasture. The farm income is derived from the sale of cattle, sheep, poultry, and produce. The farm is owned, managed and operated by Mr. Hybarger and family. The family at home consists of Mr. and Mrs. Hybarger and two children. One hired man, residing in the home, is kept the year round and extra help hired during planting and harvest time. The farm is supplied electricity from a 2300 volt primary line through a 1½ kva. transformer. A 110 volt 2-wire service is run from the transformer to a 30 ampere entrance switch. The connected load consists of 1.0 kw. in lights and 1.85 kw. in equipment, a total of 2.85 kw. The cost of wiring the farm for lights and equipment was around $150.

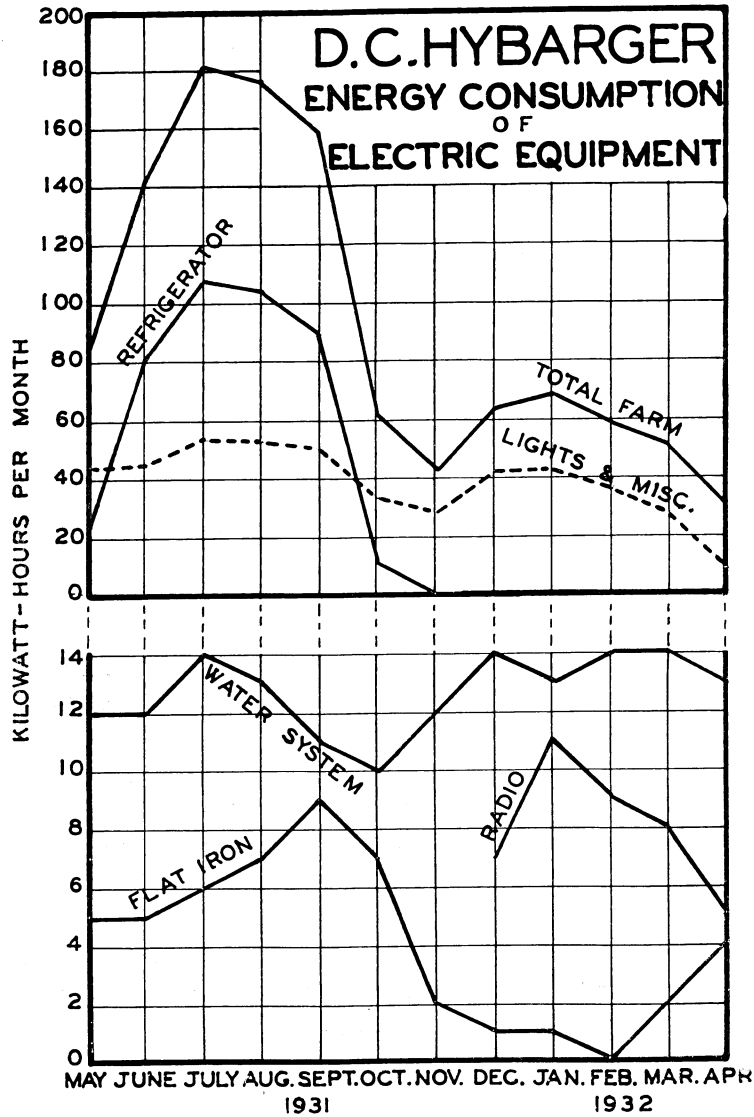
The Home: The residence is an eight-room wooden structure equipped with electric lights, running water, sewage disposal system, and natural gas heat. Electric conveniences used in the home other than lights are refrigerator, radio, washing machine, flat iron, percolator, and pressure water system that supplies running water to the house, poultry houses and wash house. The cost of this equipment when purchased was estimated to be $675.

Farm Buildings: The improvements besides the residence consist of 2 general barns, cow shed, 6 poultry houses, 3 brooder houses, wash house, garage and tenant house used for granary. The garage, wash house, one barn, poultry house and brooder houses are wired for lights. The wash house, poultry houses and brooder houses are also supplied with running water and natural gas heat.

Farm Equipment: No electric equipment is used in farming operations. Other power equipment on the farm is a motor truck for hauling produce, and a windmill. The windmill is used to supply water for stock, and to pump water into a ground level storage tank from which the house pressure supply is taken.

Livestock and Poultry: An inventory of July 21, 1931, gave 28 head of cattle, and 2300 chickens.

Crops: The 1931 production was 16 acres of wheat, 14 acres of oats, 45 acres of tame pasture and 40 acres of wild pasture. All of the feed grown was fed to stock on the farm. Additional feed was purchased for the feeding of cattle, sheep and poultry during the year.


D.C.HYBARGER
ENERGY CONSUMPTION
OF
ELECTRIC EQUIPMENT
KILOWATT-HOURS PER MONTH
200
180
160
140
120
100
80
60
40
20
0
REFRIGERATOR
TOTAL FARM
LIGHTS & MISC.
14
12
10
8
6
4
2
0
WATER SYSTEM
RADIO
FLAT IRON
MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.
1931
1932

D. C. Hybarger

Monthly Kilowatt-hour Consumption of Electric Equipment From April, 1931, to May, 1932.

Month	Total kw-hr.	House refrig-erator	Water system‡	Radio	Flat-iron	Lights and misc.
May	84	23	12		5	44
June	143	81	12		5	45
July	182	108	14		6	54
August	177	104	13		7	53
September	159	89	11		9	50
October	62	12	10		7	33
November	42		12		2†	28
December	64		14	7	1†	42
January	68		13	11	1†	43
February	59		14	9	0†	36
March	51		14	8	2†	27
April	30		13	5	4	8
TOTAL	1121	417	152	40	49	463
Average	93.4	83.4*	12.7	8	6.1†	38.6

Monthly Energy Consumption Cost of Electric Equipment From April, 1931, to May, 1932.

Month	Total bill	Average cost per kw-hr.	House refrig-erator	Water system‡	Radio	Flat-iron	Lights and misc.
May	$7.52	8.95¢	$2.06	$1.07		$0.45	$3.94
June	9.29	6.50	5.26	0.78		0.33	2.92
July	10.46	5.75	6.21	0.80		0.35	3.10
August	10.31	5.83	6.06	0.76		0.40	3.09
September	9.77	6.15	5.47	0.68		0.55	3.07
October	6.86	11.06	1.33	1.11		0.77	3.65
November	5.94	14.14		1.70		0.28†	3.96
December	6.92	10.81		1.51	$0.76	0.11†	4.54
January	7.04	10.35		1.35	1.14	0.10†	4.45
February	6.77	11.47		1.61	1.03	0†	4.13
March	6.53	12.80		1.79	1.02	0.26†	3.46
April	5.10	17.00		2.21	0.85	0.68	1.36
TOTAL	$92.51		$26.39	$15.37	$4.80	$4.28	$42.67
Average	7.71	8.25¢	5.28*	1.28	0.96	0.54†	3.56

* Based on 5 months operation.

† During November, December, January, February and March all of the ironing was not done off the iron meter. Because of this the monthly average was based on 8 months use.

‡ The final meter calibration showed the meter to be in error greater than the allowable limit; this error was adjusted in the data given.

Connected load in kilowatts: lights 1.0, equipment 1.85, total 2.85.

The consumption of the water system includes the cellar lights. This system furnishes water from a cistern and ground level storage tank for an average of 5 people, 1650 chickens and 3 calves.

The radio is a 5-tube set.

The refrigerator has a capacity of 9 cu. ft.

The flat iron is a 6-pound 575-watt electric iron. It is used to do the ironing for 5 people, requiring about 2½ hours per week for the ironing of around 35 pieces.

"Lights and misc." include house lights, barn lights, poultry house lights, washing machine and percolator.

ROY KNEELAND—DAIRY

General Facts: Mr. Roy Kneeland's address is R. F. D. No. 3, Guthrie, Oklahoma. The farm is located 1½ miles east and 1 mile north of Guthrie. It is a dairy farm of 330 acres; 220 acres of the land is owned by Mr. Kneeland and the other 110 acres is leased to him. The farm income is derived from the sale of milk and surplus dairy cattle. An average of 29 cows were milked during the year, and the milk retailed to customers in Guthrie. The dairy was in charge of Mr. F. A. Bernd until August, 1931; from then on it was in charge of Mr. Glen McWilliams. These men were employed by Mr. Kneeland to operate the dairy. In addition to the man in charge, two hired men are kept the year round and extra help hired during the rush season. The farm is supplied electricity from a 22,000 volt primary line through a 5 kva. transformer. A 110-220 volt 3-wire service is run from the transformer to a 100 ampere entrance switch. The connected load consists of 2.69 kw. in lights and 14.65 kw. in equipment, a total of 17.34 kw. The wiring for the farm was installed at a cost of around $125.

The Home: The residence of Mr. Kneeland is a five-room wooden structure, equipped with the conveniences of electric lights, running water, natural gas heat, and sewage disposal system. Electric conveniences used in the home besides electric lights are electric range, refrigerator, flat iron, vacuum cleaner, and radio. The cost of this equipment when purchased was estimated to be $625.

Tenant Houses: Two houses in addition to the home are located on the farm for the residences of the hired men. One of these, the residence of Mr. McWilliams, is a five-room wooden structure equipped with lights, running water and natural gas heat. Electric conveniences used are flat iron and radio. The other house is a three-room stone structure equipped with electric lights, running water, and natural gas heat.

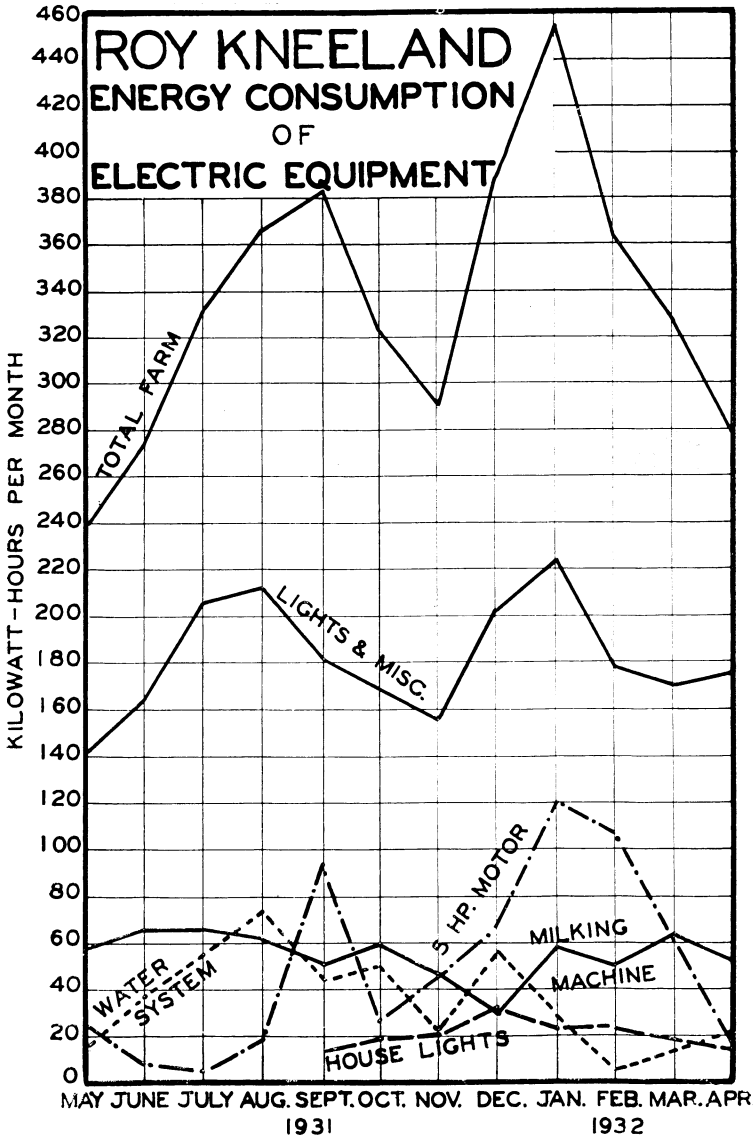
Farm Buildings: The improvements other than houses are dairy barn, horse barn, hay barn, calf barn, cattle shed, milk house, granary, 3 poultry houses, brooder house, shop, garage, smoke house and silo. The dairy barn, horse barn, 2 poultry houses, brooder house, milk house, smoke house and garage are wired for lights. The brooder house and milk house are supplied with natural gas heat. The dairy barn and milk house are supplied with running water.

Farm Equipment: A ½ horsepower motor was used with pump jack, as a standby source of power for pumping water, when the water supplied by the windmill was not sufficient for the farm use. The water is pumped into an overhead storage tank and from here piped to the houses, barn, milk house, and barnyards. In the dairy barn a milking machine is used. A 5 horsepower motor drives a combination cutter and burr mill for grinding feed and cutting ensilage. The cost of this equipment when purchased was estimated to be $910. A truck used in milk delivery is another source of power on the farm.

Livestock and Poultry: An inventory of September 1, 1931, gave 65 head of cattle, 6 horses and 300 chickens.

Crops: The 1931 production was 35 acres of corn, 35 acres of oats, 20 acres of cane, 3 acres of beets, 35 acres of prairie hay, 30 acres of alfalfa and 125 acres of wild pasture. The feed grown was fed to stock on the farm. In addition to the crops grown some oats, corn, kafir and oil meal were purchased during the year for feed.

Mr. Kneeland's combination cutter and burr mill that is driven by a 5 horsepower motor and used for processing grain and roughage at an average cost of 4.8 cents per 100 pounds.


ROY KNEELAND
ENERGY CONSUMPTION
OF
ELECTRIC EQUIPMENT
KILOWATT-HOURS PER MONTH
460
440
420
400
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
TOTAL FARM
LIGHTS & MISC.
5 HP. MOTOR
MILKING MACHINE
WATER SYSTEM
HOUSE LIGHTS
MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.
1931
1932

Roy Kneeland—Dairy

Monthly Kilowatt-hour Consumption of Electric Equipment
From April, 1931, to May, 1932.

Month	Total kw-hr.	5 hp. motor	Milking machine	Water system**	Tenant house lights	Lights and misc.
May	240	24	58	16		142*
June	273	8	65	37		163*
July	331	4	66	55		206*
August	366	18	62	74		212*
September	382	93	50	44	14	181
October	322	26	59	50	18	169
November	289	45	46	22	21	155
December	388	67	29†	57	32	203
January	454	120	58	29	23	224
February	363	107	50	5	23	178
March	327	62	63	14	18	170
April	279	17	52	21	14	175
TOTAL	4014	591	658	424	163	2178
Average	334.5	49.25	57	35.3	20.4	181.5

Monthly Energy Consumption Cost of Electric Equipment
From April, 1931, to May, 1932.

Month	Total bill	Average cost per kw-hr.	5 hp. motor	Milking machine	Water system**	Tenant house	Lights and misc.
May	$20.27	8.45¢	$2.03	$4.90	$1.35	$0.00	$11.99*
June	21.31	7.81	0.63	5.07	2.89	0.00	12.72*
July	23.14	6.99	0.28	4.61	3.85	0.00	14.40*
August	24.24	6.62	1.19	4.11	4.90	0.00	14.04*
September	24.74	6.48	6.02	3.24	2.85	0.91	11.72
October	22.85	7.10	1.85	4.19	3.55	1.27	11.99
November	21.81	7.55	3.40	3.47	1.66	1.58	11.70
December	24.93	6.43	4.31	1.86†	3.66	2.06	13.04
January	27.01	5.95	7.14	3.45	1.73	1.37	13.32
February	24.14	6.65	7.12	3.32	0.33	1.53	11.84
March	23.01	7.04	4.36	4.43	0.99	1.27	11.96
April	21.50	7.71	1.31	4.01	1.62	1.08	13.48
TOTAL	$278.95		$39.64	$46.66	$29.38	$11.07	$152.20
Average	23.25	6.95¢	3.30	4.04	2.45	1.38	12.68

* Tenant house lights included.

† The milker was not used for 2 weeks; this was compensated for in computing monthly average.

**Water was used from a 65-foot well for the cooling of 46 gallons of milk per day; for washing out of dairy barn and milk house and for an average of 10 people, 60 head of cattle, 7 horses, and 315 chickens. A windmill was used to pump the water into a large elevated storage tank. An electric motor and pump jack was used as a standby for pumping when the mill did not furnish sufficient water.

Connected load in kilowatts: lights 2.69, equipment 14.65, total 17.34.

"Lights and misc." include the lights of two houses, dairy barn, horse barn, poultry house, yard and garage, and in addition a house refrigerator, electric iron, range and radio.

The tenant house lights include the consumption of radio and electric iron.

Roy Kneeland—Dairy

Five Horsepower Motor Record of Feed Grinding and Ensilage Cutting From April, 1931, to May, 1932.

Month	Total kw-hr.	Total cost	POUNDS OF FEED						Kw-hr. per 100 lbs. feed	Cost per 100 lbs. feed
			Sheaf oats	Beets	Oats	Corn	Kafir corn	Total		
May	24	$2.03	1,350					1,350	1.78	15.0¢
June	8	0.63	400					400	2.00	15.8
July	4	0.28				600		600	0.67	4.7
August	18*	1.19*			2,545			2,545	0.47	3.1
September	93**	6.02**			1,030	2,700		3,730	0.38	2.4
October	26**	1.85**	300		3,280			3,580	0.53	3.8
November	45	3.40		19,000	2,140		500	21,640	0.21	1.6
December	67	4.31		2,500	1,350		1,350	5,650†	1.19	7.6
January	120	7.14	6,000			1,000	3,400	10,400	1.15	6.9
February	107	7.12	5,400			775	2,700	8,875	1.21	8.0
March	62	4.36	5,575		1,400		1,140	8,115‡	0.76	5.4
April	17	1.31	2,440				1,100	3,540	0.48	3.7
TOTAL	591	$39.64	21,465	21,500	11,745	5,075	10,190	70,225		
Average	49.25	3.30						5,852	0.71	4.8¢

* 2.1 tons of ensilage was cut for which the energy required was estimated at 6 kw-hr.; this is subtracted in computing unit cost of grinding.
† 450 pounds of wheat included. ‡ 100 pounds of alfalfa hay included.

** 79 kw-hr. in September and 7 kw-hr. in October, a total of 86 kw-hr., were used to cut 30 tons of corn and sorghum ensilage and elevate it into a 15-foot silo at a cost of $5.62. The consumption per ton was 2.87 kw-hr., costing 18.7 cents. The cutting was done with a combination cutter and burr mill so constructed that the ensilage dropped from the knives directly into the elevating fan.

The machine used for grinding was a combination cutter and burr mill with a 9-inch throat and 8-inch burrs. It is equipped with an elevating fan and dust collector.

During May and June sheaf oats was run through the mill at the rate of about 200 lbs. per hour and ground rather finely. Thereafter the sheaf oats was run through the mill at the rate of about 500 lbs. per hour with the burrs open, allowing the cutter to do most of the processing.

Threshed oats was ground medium fine at a rate of 500 lbs. per hour.

Corn was ground medium coarse at the rate of 1000 lbs. per hour. Kafir corn was ground rather fine at a rate of 300 lbs. per hour. 1400 lbs. of beets were processed per hour largely by the cutter, since the burrs were left open.

The low unit cost for March and April is due to sharpening of the knives and replacing of burrs.

Roy Kneeland—Dairy
Milking Machine Record From April, 1931, to May, 1932.

Month	Kw-hr.	Cost	Total pounds milk	Kw-hr. per 1000 pounds milk	Number cows	Kw-hr. per cow per mo.	Cost per cow per mo.
May	58	$4.90	14,540	3.99	30	1.94	16.3¢
June	65	5.07	15,230	4.27	35	1.86	14.5
July	66	4.61	13,990	4.72	33	2.00	14.0
August	62	4.11	11,200	5.54	28	2.21	14.7
September	50	3.24	10,320	4.84	26	1.92	12.5
October	59	4.19	10,670	5.53	27	2.19	15.5
November	46	3.47	9,680	4.75	29	1.59	12.0
December	29*	1.86*	6,000*	4.83	27	1.96	12.6
January	58	3.45	13,330	4.35	30	1.94	11.4
February	50	3.32	10,720	4.66	29	1.72	11.4
March	63	4.43	12,000	5.25	29	2.17	15.3
April	52	4.01	11,870	4.38	28	1.86	14.3
TOTAL	658	$46.66	139,550				
Average	57	4.04	12,084	4.72	29.3	1.94	13.8¢

* The machine was not used for two weeks; this is compensated for in computing unit, and average values.

Average cost per 1000 pounds of milk, 33 cents.

Average time required per day for milking, 2 hours and 30 minutes.

It is a 2-unit machine of the pipe line type, equipped with vacuum pulsator and driven by a ½ horsepower motor.

R. F. MacARTHUR

General Facts: Mr. R. F. MacArthur's address is 520 North Cheyenne street, Tulsa, Oklahoma. The farm is located 2 miles south and 1 mile east of Catoosa, Oklahoma, on State Highway No. 11. It is a general stock and poultry farm with 72 acres of land and is owned, managed and operated by Mr. and Mrs. MacArthur. One hired man is kept the year round and extra help hired throughout the year for improving the place. The farm income is derived from the sale of livestock, poultry and produce. Electricity is furnished the farm from a 2300 volt primary line through a 3-kva. transformer. A 110 volt 2-wire service is run from the transformer to two 30 ampere entrance switches. The house and barn are served through one switch and meter, and a second house and the poultry house are served through the other switch and meter. The connected load consists of 1.17 kw. in lights and 4.78 kw. in equipment, a total of 5.95 kw. The wiring and fixtures for the farm were installed at an estimated cost of around $125.

The Home: Two small houses are located on the farm as the country home of the MacArthurs. One of these is a 3-room wooden structure and is used as living quarters. The other is a 4-room wooden structure used by the hired man, Mr. Hemmingsen, and as sleeping quarters for Mr. and Mrs. MacArthur when staying on the farm. The houses are equipped with electric lights, running water, sewage disposal, and natural gas heat. Electric conveniences used in the home other than lights are refrigerator, radio, toaster, percolator, and sausage mill. The cost of this equipment when purchased was estimated to be $700.

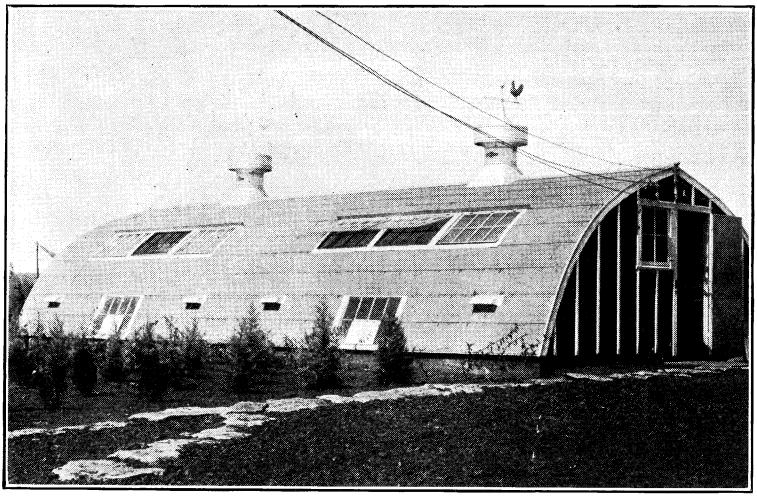
Farm Buildings: The improvements other than residences consist of general barn with a poultry house attached, 2 brooder houses, poultry house, 4 small hog houses, and rabbit hutch. The barn and poultry houses

are wired for lights and equipment. In addition to lights, the poultry house is supplied with running water and natural gas heat.

Farm Equipment: The electric equipment of the farm consists of two battery type brooders, stock tank water heater, and shop motor for driving saw, planer, and other wood tools. The cost of this equipment when purchased was estimated to be $235. Other power equipment used on the farm consists of 2 farm tractors, a truck, and a gasoline engine for pumping water into a storage tank that supplies running water to the houses, poultry house and barn lot.

Livestock and Poultry: An inventory of August 10, 1931, gave 4 head of cattle, 26 hogs, 50 rabbits, and 600 chickens.

Crops: The 1931 production was 9 acres of corn, 10 acres of oats, 10 acres of alfalfa, and 20 acres of wild pasture. The remaining part of the land is taken up by timber and farm lots. All of the feed grown and that purchased was fed to stock on the farm.



One of the two poultry houses at the R. F. MacArthur farm in which lights are used for egg production during the winter at a cost of 98 cents per month.

R. F. MacArthur

Monthly Kilowatt-hour Consumption of Electric Equipment From April, 1931, to May, 1932.

Month	Total kw-hr.	House refrig-erator	Brooder	Stock tank water heater	Poultry house lights	Lights and misc.
May	222	70	119	0		33
June	106	80	0	0		26
July	107	87	0	0		20
August	100	80	0	0		20
September	96	73	0	0		23
October	105	64	0	0		41
November	120	49	0	0		71
December	133	42	0	4		87
January	180	39	0	60		81
February	240	40	0	132	8*	60
March	187	56	0	69	6*	56
April	106	65	0	0	0	41
TOTAL	1702	745	119	265	14	559
Average	142	62	119	66	14*	47

Monthly Energy Consumption Cost of Electric Equipment From April, 1931, to May, 1932.

Month	Total cost	Average cost per kw-hr.	House refrig-erator	Brooder	Stock tank water heater	Poultry house lights	Lights and misc.
May	$15.14	6.82¢	$4.77	$8.12			$2.25
June	11.50	10.85	8.68				2.82
July	11.45	10.70	9.31				2.14
August	11.16	11.16	8.93				2.23
September	11.00	11.46	8.36				2.64
October	11.39	10.85	6.94				4.45
November	12.12	10.10	4.95				7.17
December	12.87	9.68	4.06		$0.39		8.42
January	14.12	7.84	3.06		4.71		6.35
February	15.76	6.57	2.63		8.67	$0.52*	3.94
March	14.29	7.64	4.28		5.27	0.46*	4.28
April	11.70	11.04	7.18				4.52
TOTAL	$152.50		$73.15	$8.12	$19.04	$0.98	$51.21
Average	12.71	8.96¢	6.09	8.12	4.76	0.98*	4.27

* The meter was set on poultry house lights only 14 days in February and the lights were only used part of the month of March, so the total was taken as the monthly average.

Connected load in kilowatts: lights 1.17, equipment 4.78, total 5.95.

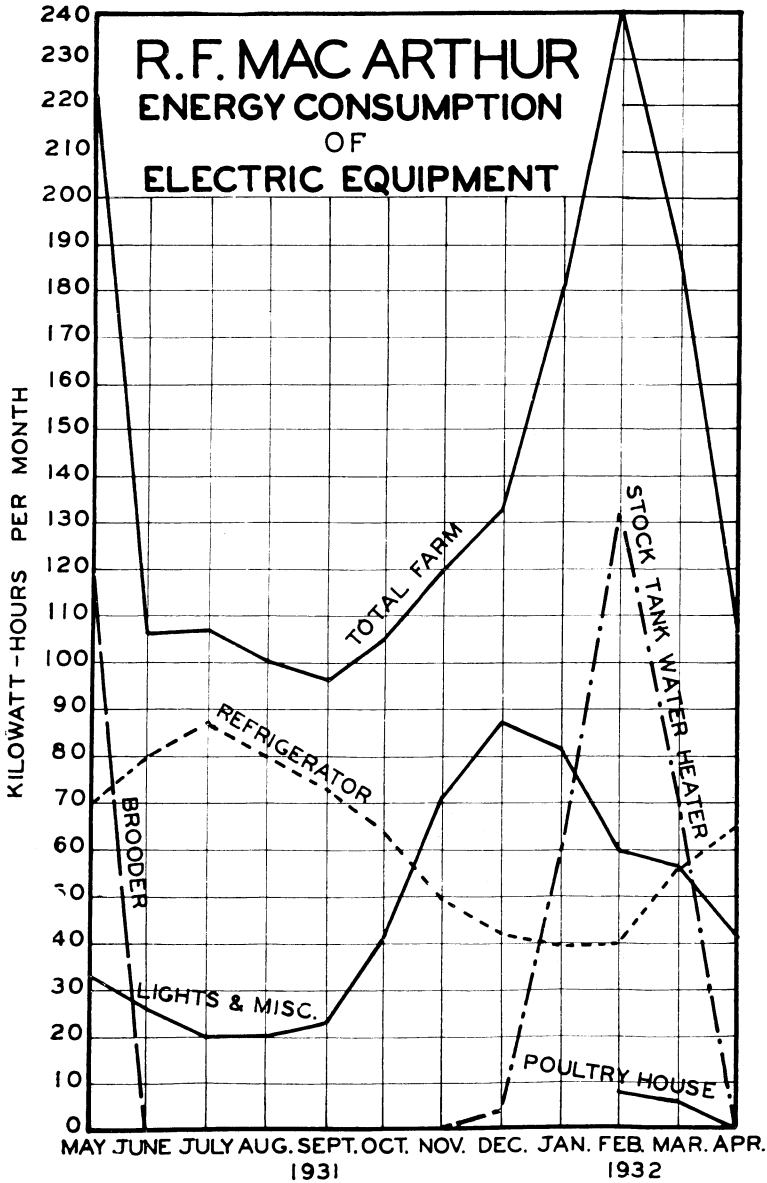
The brooder used was a 500-chick capacity, 10-section, battery type. Six sections were used and the brooder temperature maintained around 90°F. with the room temperature at around 70°F. 150 chicks were brooded with a loss of 13.3%. The consumption per chick for the brooding period was 0.85 kilowatt-hour at a cost of 5.4 cents.

The stock tank heater was a 1 kilowatt immersion type heater used to prevent the tank water from freezing.

The refrigerator has a capacity of 6 cu. ft.

Three 60-watt lamps were used from 4:30 a. m. to daybreak during October, November, December, January, February and March to light the poultry house for 250 hens.

"Lights and misc." include the lights of two houses, poultry house and barn, and the consumption of radio, toaster, percolator, sausage mill and shop motor.



I. F. MELROSE

General Facts: Mr. I. F. Melrose's address is R. F. D. No. 5, Oklahoma City, Oklahoma. The farm is located 8 miles west of Broadway and ½ mile north of Reno Street road out of Oklahoma City. It is a general stock farm of 200 acres. The farm is owned, managed and operated by Mr. Melrose and son. One hired man is kept the year round and extra help hired during harvest and silo filling time. The farm income is derived from the sale of cattle, hogs and grain, with the addition of poultry and produce sales. The farm is supplied electricity from a 4000 volt primary line through a 5 kva. transformer. A 110-220 volt 3-wire service is run from the transformer to a 60 ampere entrance switch. The connected load is 1.2 kw. of lights and 9.46 kw. of equipment, a total of 10.66 kw. The wiring and fixtures for the farm were installed at a cost of around $200.

The Home: The house is a wooden structure of eight rooms and bath, and is equipped with electric lights, running water, and sewage disposal system. A wood and coal stove is used for heating during the winter months. Electric conveniences used in addition to lights are toaster, vacuum cleaner, washing machine, waffle iron, fireless cooker, one-unit hot plate, and floor lamps. The cost of this equipment when purchased was estimated to be $175.

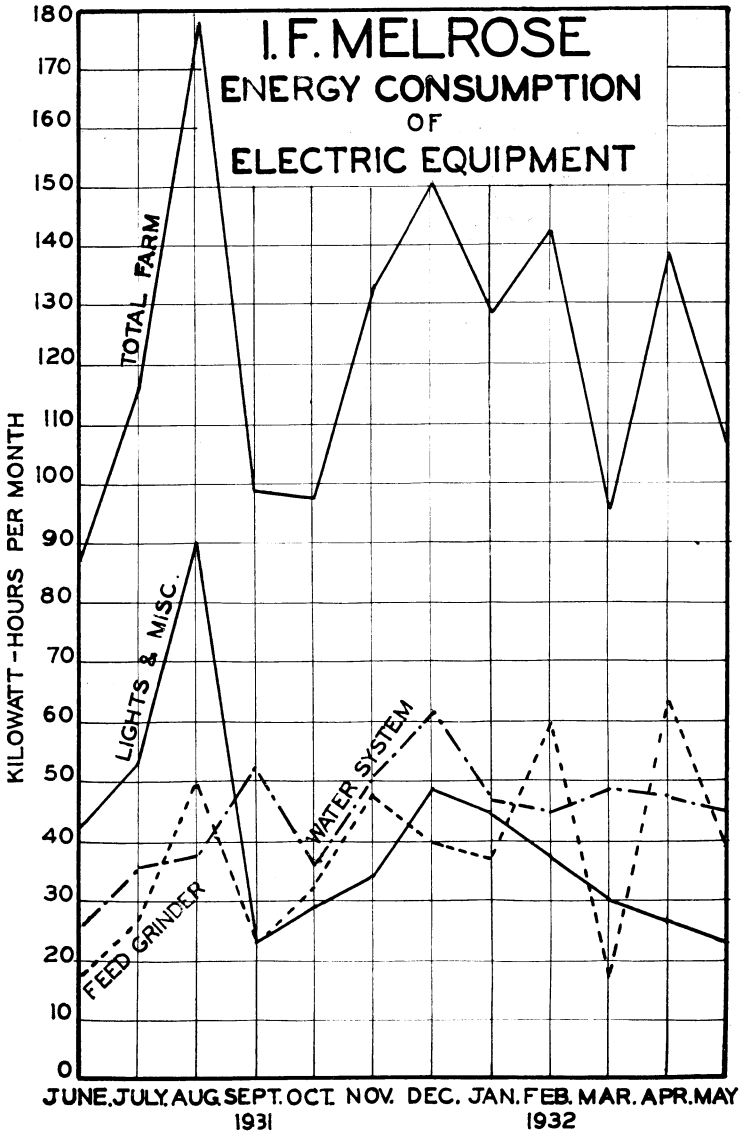
Tenant House: The tenant house is the residence of the hired man. It is a three-room wooden structure in good repair, but is not wired for lights or equipment.

Farm Buildings: The improvements, in addition to houses, are general barn for horses and cattle, combined machine shed and granary, garage and shop, poultry house, and silo. Of these buildings the barn and garage are the only ones wired for lights and equipment.

Farm Equipment: A pressure water system furnishes water for the house and for farm use. A 5 horsepower motor is used to drive feed grinder, and ensilage cutter. A ¼ horsepower portable motor supplies power for a fanning mill, corn sheller and emery wheel. A one horsepower motor is used for garden irrigation and for other odd jobs about the farm. The cost of this equipment when purchased was estimated to be $375. Other power equipment on the farm consists of a two-plow tractor and a three-plow tractor.

Livestock and Poultry: An inventory of July 27, 1931, gave 17 head of cattle, 12 horses, 30 hogs, and 100 chickens. Most of the stock was raised on the farm. Twenty head of calves were purchased for feeding purposes during the 12 months preceding July 27.

Crops: The 1931 production was 40 acres of corn, 30 acres of oats, 80 acres of barley, 25 acres of tame pasture, and 20 acres of wild pasture. The greater part of the feed grown was fed to stock on the farm with the addition of some meat meal and cotton seed meal purchased as supplement.


I. F. MELROSE
ENERGY CONSUMPTION
OF
ELECTRIC EQUIPMENT
KILOWATT-HOURS PER MONTH
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
TOTAL FARM
LIGHTS & MISC.
WATER SYSTEM
FEED GRINDER
JUNE. JULY. AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY
1931
1932

I. F. Melrose

Monthly Kilowatt-hour Consumption of Electric Equipment From May, 1931, to June, 1932.

Month	Total kw-hr.	Feed grinder	Water system	Lights and miscellaneous
June	87	18	26	43
July	116	27	36	53
August	178	50	38	90
September	99	23	53	23
October	98	33	36	29
November	133	48	51	34
December	151	40	62	49
January	129	37	47	45
February	143	60	45	38
March	96	17	49	30
April	139	64	48	27
May	107	39	45	23
TOTAL	1476	456	536	484
Average	123	38	44.7	40.3

Monthly Energy Consumption Cost of Electric Equipment From May, 1931, to June, 1932.

Month	Total bill	Average kw-hr. cost	Feed grinder	Water system	Lights and misc.
June	$10.00	11.49¢	$2.07	$2.99	$4.94
July	10.91	9.41	2.54	3.39	4.98
August	12.86	7.22	3.61	2.75	6.50
September	10.37	10.47	2.41	5.55	2.41
October	10.34	10.55	3.48	3.80	3.06
November	11.45	8.61	4.13	4.39	2.93
December	12.01	7.95	3.19	4.93	3.90
January	11.32	8.78	3.25	4.12	3.95
February	11.76	8.22	4.93	3.70	3.13
March	10.28	10.71	1.82	5.25	3.21
April	11.63	8.37	5.35	4.02	2.26
May	10.63	9.93	3.87	4.47	2.29
TOTAL	$133.56		$40.64	$49.36	$43.56
Average	11.13	9.05¢	3.39	4.11	3.63

Connected load: lights 1.2 kw., equipment 9.46 kw., total 10.66 kw.

"Lights and misc." include house lights, barn lights, garage and washhouse lights, ¼ horsepower motor on sheller, grinder and fanning mill, toaster, iron, vacuum cleaner, washing machine, waffle iron, hot plate and a 1 hp. motor for garden irrigation.

The water system furnishes water from a 50-foot well for an average of 8 people, 10 horses, 20 head of cattle, 20 hogs and 190 chickens.

I. F. Melrose
Feed Grinding Record From May, 1931, to June, 1932.

Month	Total kw-hr.	Total cost	POUNDS FEED GROUND				Kw-hr. per 100 pounds	Cost per 100 pounds
			Oats	Ear corn	Barley	Total		
June	18	$2.07	1,150	3,270		4,420	0.407	4.68¢
July	27	2.54	4,320	6,610		10,930	0.247	2.32
August	50*	3.61*	2,630		11,820	14,450	0.273*	2.00*
September	23*	2.41*						
October	33	3.48	2,450	2,060		4,510	0.731	7.72
November	48	4.13	3,925	2,500		6,425	0.747	6.43
December	40	3.18	3,745	2,725		6,470	0.618	4.91
January	37	3.25	2,090		1,140†	3,230	1.14	10.06
February	60	4.93	3,490	2,230		5,720	1.05	8.62
March	17	1.82	1,980			1,980	0.859	9.19
April	64	5.35	5,160			5,160	1.24	10.37
May	39	3.87	4,275			4,275	0.912	9.05
TOTAL	456	$40.64	35,215	19,395		67,570		
Average	38	3.39	2,934	1,616		5,631	0.626*	5.55¢*

* 33 kilowatt-hours used during August and September for silo filling is not included in the calculation of unit consumption and cost.

† Milo.

Average pounds of feed ground per hour, 1060.
Fineness of grinding, medium.
The mill is of the burr type, equipped with 8″ burrs and bucket type elevator, and is driven with a 5 horsepower motor.

W. H. ODOR

General Facts: Mr. W. H. Odor's address is Arcadia, Oklahoma. The farm is located ½ mile east of Arcadia. It is a general purpose farm with 320 acres of land. The farm income is derived from the sale of livestock, cream and grain. Cattle and hogs are fed for market, and around 50 cows are milked during the fall, winter and spring months. The milk is separated and the product sold as cream. The farm is owned, managed and operated by Mr. and Mrs. Odor. Two hired men are kept the year round and extra help hired during the rush seasons. The farm is supplied electricity by a 800 watt 32 volt, battery type, individual light plant. The connected load consists of 0.7 kw. in lights, and 2.0 kw. in equipment, a total of 2.7 kw. The cost of the plant, exclusive of wiring and fixtures for the farm, when purchased was around $400.

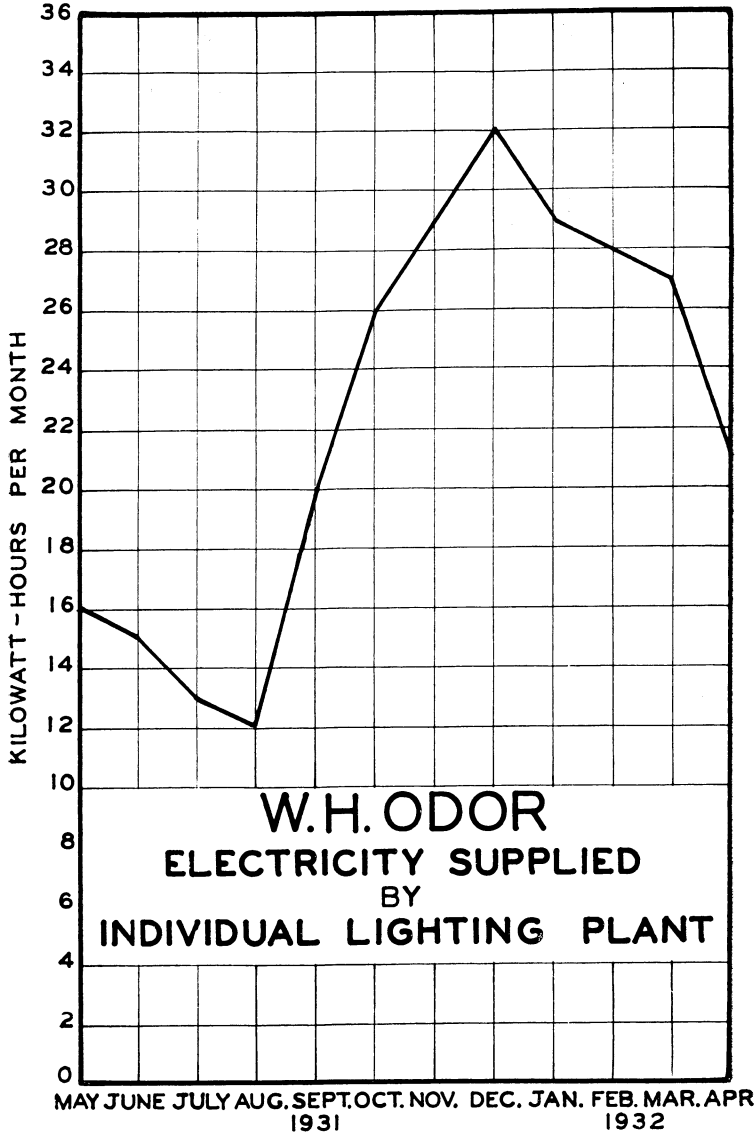
The Home: The residence is a two-story wooden structure with eight rooms and bath. It is equipped with electric lights, running water and sewage disposal system. The cooking is done with bottled gas and the house is heated during the winter months by a wood furnace. Electric conveniences used in the home other than lights are washing machine, vacuum cleaner, toaster, flat iron and radio. The cost of this equipment when purchased was estimated to be $350.

Farm Buildings: Improvements besides the house consist of general barn, stock shed, milk house, poultry house, shop, garage, and tenant house used for a granary. The general barn, and milk house are wired for and equipped with lights.

Farm Equipment: The only electric equipment used outside the home is a cream separator. The cost of this when purchased was estimated to be $136. Other power equipment used on the farm consists of three tractors. The tractors are used for belt power in addition to field work.

Livestock and Poultry: An inventory of September 1, 1931, gave 95 head of cattle, 3 horses, 20 hogs, and 100 chickens.

Crops: The 1931 production was 100 acres of corn, 80 acres of oats, 15 acres of alfalfa, 40 acres of tame pasture, and 60 acres of wild pasture. Part of the feed grown was fed to stock on the farm; the remainder was sold as a cash crop.



W. H. Odor

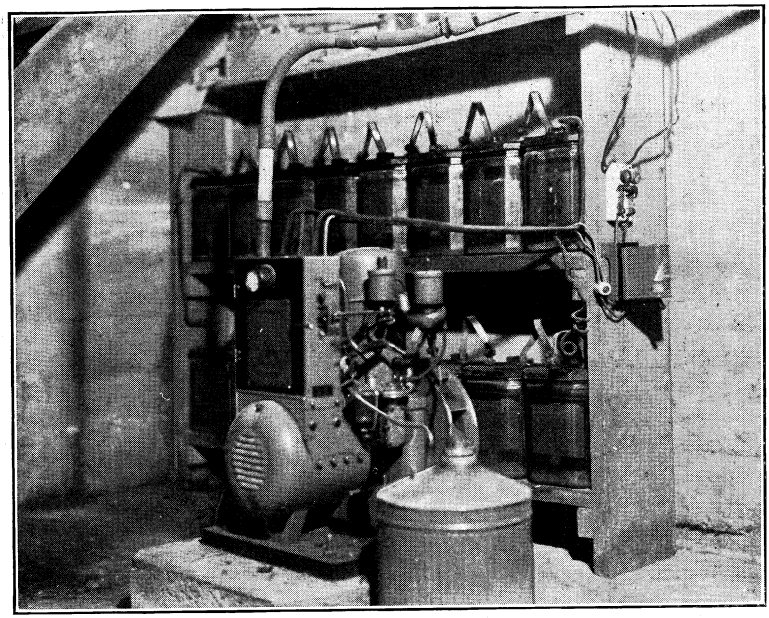
Monthly Record of Individual Electric Light Plant
From April, 1931, to May, 1932.

Month	Kw-hr. used*	GASOLINE CONSUMPTION		OIL CONSUMPTION		Repair cost
		Gallons	Cost	Gallons	Cost	
May	16	9.5	$0.71			
June	15	9.0	0.56			
July	13	5.0	0.30			$5.00
August	12	9.3	0.55	0.50	$0.30	
September	20	13.0	0.90			
October	26	13.0	1.89			
November	29	15.0	1.45	0.25	0.20	
December	32	15.0	1.50	0.50	0.40	
January	29	20.0	1.90			
February	28	18.0	1.62	0.50	0.40	
March	27	21.0	1.89	0.75	0.65	
April	21	17.0	1.53			
TOTAL	268	164.5	$14.80	2.50	$1.95	$5.00
Average	22.3	13.7	1.23	0.21	0.16	0.42

* This meter was not calibrated by the College Standard.

Gallons of gasoline per kw-hr., 0.61. Gallons of oil per kw-hr., 0.0093.
Connected load of the plant in kilowatts: lights 0.7, equipment 2.0, total 2.7.
The plant is a 32 volt, battery type with a capacity of 800 watts.
The cost of the plant including batteries was $400.
The estimated cost of the batteries was $125.
Estimated life of plant, 10 years. Estimated life of batteries, 5 years.

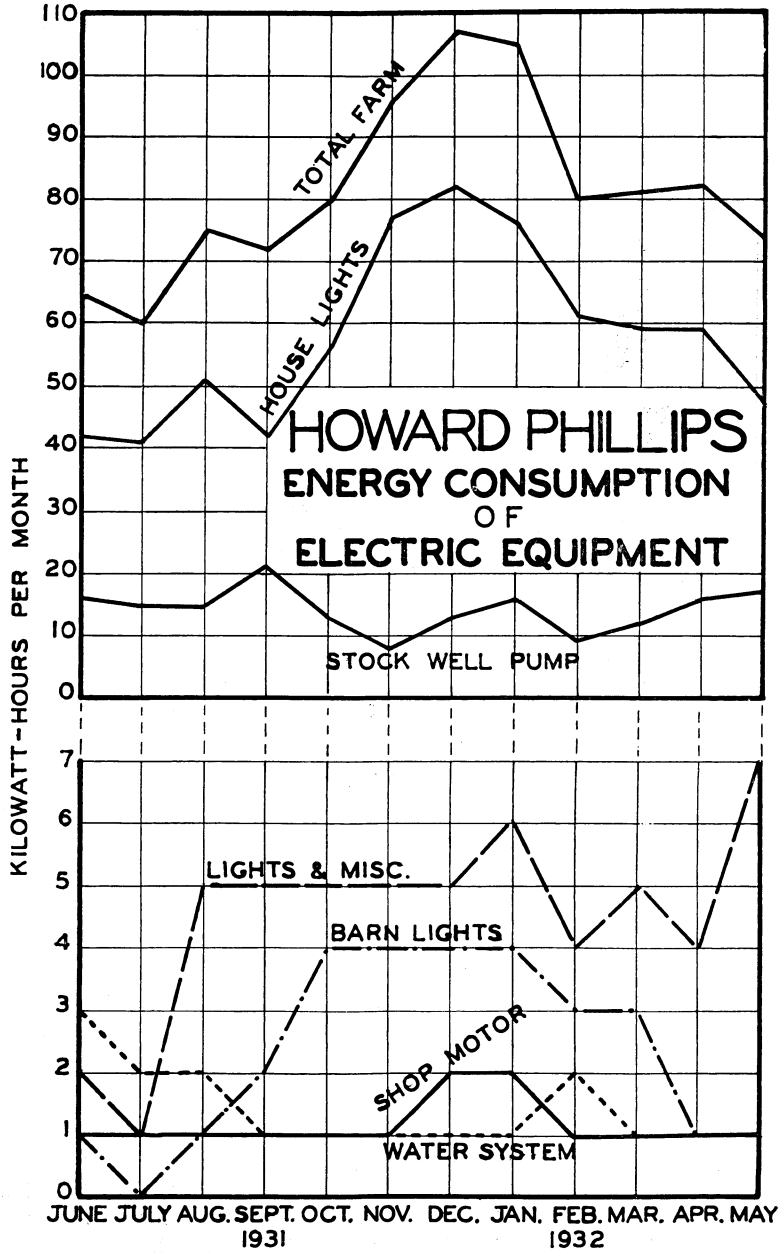
Interest and taxes per year on average value of $200 at 8%	$16.00
Depreciation per year on $275 value of plant	27.50
Depreciation per year on $125 value of batteries	25.00
Total fixed charge per year of operation	$68.50
Gasoline, oil and repair cost per year	21.75
Total cost per year of operation	$90.25
Fixed charge per month of operation	$ 5.71
Gasoline, oil and repair cost per month	1.81
Total cost per month of operation	$ 7.52
Gasoline cost per kilowatt-hour	5.52¢
Oil cost per kilowatt-hour	0.73
Repair cost per kilowatt-hour	1.87
Total of gasoline, oil and repair cost per kilowatt-hour	8.12¢
Fixed charge cost per kilowatt-hour	25.56
Total cost per kilowatt-hour used	33.68¢



The 32-volt individual lighting plant that supplies electric service to the W. H. Odor home. An average of 22.3 kilowatt-hours were used from this plant per month, the cost of which was 33.68 cents per kilowatt-hour.

HOWARD W. PHILLIPS

General Facts: Mr. Howard W. Phillips' address is R. F. D. No. 1, Sand Springs, Oklahoma. The farm is located 1 mile south and 2 miles west of Sand Springs. Mr. Phillips' total holding here consists of 1500 acres of land and 5 sets of improvements. Four sets of the improvements and 400 acres of the land are leased to and farmed by tenant farmers. These improvements and land are located apart from the home residence, are not supplied with electric service, and for the purpose of this report will not be considered a part of the farm. The remaining 1100 acres of land are used for general farming, and are managed and operated by Mr. Phillips and family. The family consists of Mr. and Mrs. Phillips, two daughters and two sons. Two hired men are kept the year round and extra help hired during rush seasons. The farm income is derived from the sale of grain, hay and livestock. Electricity is supplied the farm from a 2300 volt primary line through a 5-kva. transformer. A 110-220 volt 3-wire service is run from the transformer to a 30 ampere entrance switch. The connected load consists of 2.68 kw. in lights, and 3.96 kw. in equipment, a total of 6.64 kw. The wiring and fixtures for the farm were installed at a cost of around $350.


HOWARD PHILLIPS
ENERGY CONSUMPTION
OF
ELECTRIC EQUIPMENT
KILOWATT-HOURS PER MONTH
TOTAL FARM
HOUSE LIGHTS
STOCK WELL PUMP
LIGHTS & MISC.
BARN LIGHTS
SHOP MOTOR
WATER SYSTEM
110
100
90
80
70
60
50
40
30
20
10
0
7
6
5
4
3
2
1
0
JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY
1931
1932

The Home: The residence is a two-story 10-room wooden structure equipped with electric lights, running water, and sewage disposal system. A wood stove is used for heating during the winter months. Electric conveniences used in the home other than lights are washing machine, radio, vacuum cleaner, toaster, flat iron, waffle iron, heating pad, portable fan, and pressure water system that supplies running water to the house from the cistern. The cost of this equipment when purchased was estimated to be $480.

Tenant House: One four-room house is located on the farm in addition to the home residence. It is a wood structure in good repair, but is not wired for light and equipment or supplied with running water.

Farm Buildings: The improvements in addition to houses consist of general barn, two granaries, stock and hay shed, machine shed, three hog houses, garage, shop, oil house, poultry house, and wash house. The barn, granary, machine shed, oil house, shop, and wash house are wired for lights and equipment.

Farm Equipment: The electric equipment used outside the home consists of a 1 horsepower motor in the shop for driving emery wheel and buffer, and a ¼ horsepower motor, combined with pump jack, for pumping water into the stock tank. The cost of this equipment when purchased was estimated to be $125. Other power equipment used on the farm is two tractors and a farm truck. The tractors are used for driving threshing machine, feed grinder, corn sheller, and hay baler in addition to field work.

Livestock and Poultry: An inventory of August 3, 1931 gave 13 head of cattle, 8 horses, 20 hogs, and 250 chickens.

Crops: The 1931 production was 50 acres of wheat, 75 acres of oats, 150 acres of barley, 60 acres of tame pasture and 80 acres of prairie hay. The remaining land is rough, timber pasture. Some of the feed grown is fed to stock on the farm, and remainder sold as a cash crop.

Howard W. Phillips
Monthly Kilowatt-hour Consumption of Electric Equipment
From May, 1931, to June, 1932.

Month	Total kw -hr.	Stock well pump	House water system	Shop motor	House lights	Barn lights	Lights and misc.
June	65	16	3	1	42	1	2
July	60	15	2	1	41	0	1
August	75	15	2	1	51	1	5
September	72	21	1	1	42	2	5
October	80	13	1	1	56	4	5
November	96	8	1	1	77	4	5
December	107	13	1	2	82	4	5
January	105	16	1	2	76	4	6
February	80	9	2	1	61	3	4
March	81	12	1	1	59	3	5
April	82	16	1	1	59	1	4
May	74	17	1	1	47	1	7
TOTAL	977	171	17	14	693	28	54
Average	81.4	14.3	1.4	1.2	57.8	2.3	4.5

Monthly Energy Consumption Cost of Electric Equipment From May, 1931, to June, 1932.

Month	Total bill	Average cost per kw -hr.	Stock well pump	House water system	Shop motor	House lights	Barn lights	Lights and misc.
June	$5.50*	8.64¢	$1.35	$0.25	$0.08	$3.56	$0.09	$0.17
July	5.50*	9.17	1.38	0.18	0.09	3.76	0.00	0.09
August	5.50*	7.33	1.10	0.15	0.07	3.74	0.07	0.37
September	5.50*	7.64	1.60	0.08	0.08	3.21	0.15	0.38
October	5.50*	6.88	0.89	0.07	0.07	3.85	0.28	0.34
November	5.50*	5.73	0.46	0.06	0.06	4.40	0.23	0.29
December	5.85	5.47	0.71	0.05	0.11	4.49	0.22	0.27
January	5.78	5.50	0.88	0.06	0.11	4.18	0.22	0.33
February	5.50*	6.88	0.62	0.14	0.07	4.19	0.21	0.27
March	5.50*	6.79	0.81	0.07	0.07	4.01	0.20	0.34
April	5.50*	6.71	1.07	0.07	0.07	3.95	0.07	0.27
May	5.50*	7.43	1.27	0.07	0.07	3.50	0.07	0.52
TOTAL	$66.63		$12.14	$1.25	$0.95	$46.84	$1.81	$3.64
Average	5.55	6.82¢	1.01	0.10	0.08	3.90	0.15	0.30

* Minimum bill.

Connected load in kilowatts: lights 2.68, equipment 3.96, total 6.64.

The stock well pump furnishes water from an 18-foot well for an average of 10 horses, 14 head of cattle, 12 hogs, and 110 chickens.

The house water system furnishes water from a 15-foot cistern for the house use of 4 people.

One 50 watt light is used off the shop motor meter, for shop lights. The motor has a rating of 1 hp. and is used for driving an emery wheel and buffer.

House lights include the consumption of vacuum cleaner, radio, toaster, flat iron and waffle iron.

The barn lights are for a general barn and one yard light.

"Lights and misc." include machine shed lights, oil and gas house lights, granary lights, wash house lights, and washing machine.

J. A. PURVIANCE—DAIRY

General Facts: Mr. J. A. Purviance's address is Guthrie, Oklahoma. The farm is located 2½ miles south and ½ mile west of Guthrie. It is a dairy farm of 515 acres; 290 acres of the land is owned by Mr. Purviance and the other 125 acres is leased to him. The farm income is derived from the sale of milk, cream and the increase of dairy cattle. An average of 30 cows were milked throughout the year, and the milk retailed to customers in Guthrie. The farm is managed and operated by Mr. Purviance and two sons. The family residing at home consists of Mr. and Mrs. Purviance and daughter. One hired man is kept the year round and extra help hired during harvest and silo filling time. The farm is furnished electricity from a 2200 volt primary line through a 5 kva. transformer. A 110-220 volt 3-wire service is run from the transformer to a 100 ampere main entrance switch. The connected load consists of 1.25 kw. in lights and 18.47 kw. in equipment, a total of 19.72 kw. The wiring and fixtures for the farm were installed at a cost of around $250.

The Home: The house is a two-story 11 room wooden structure. It is equipped with the modern conveniences of electric lights, running water, and sewage disposal. A coal and wood stove is used for heating during the

winter months. Electric conveniences other than lights are washing machine, radio, flat iron, vacuum cleaner, corn popper, 2 unit hot plate, reflector heater, portable fan, and toaster. The cost of this equipment when purchased was estimated to be $325.

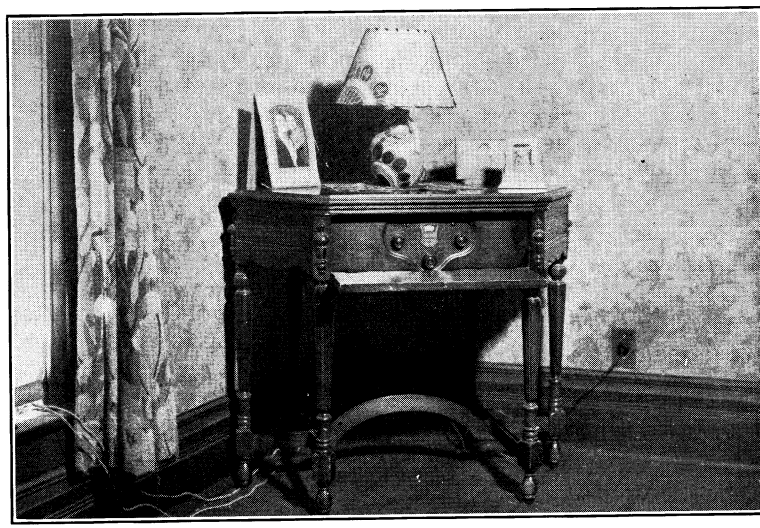
Tenant Houses: Two houses are located on the farm in addition to the home residence. These houses are the homes of Harold and Raymond Purviance and families. One of the houses is a five-room wooden structure equipped with electric lights and running water; the lights are metered separate and are not included in the farm consumption. The other house is a five-room wooden structure equipped with lights and running water.

Farm Buildings: Improvements other than houses consist of combined general barn and milk house, poultry house, hay barn, granary, garage and two silos. The barn, poultry house and garage are wired for lights. The poultry house and barn are supplied with running water.

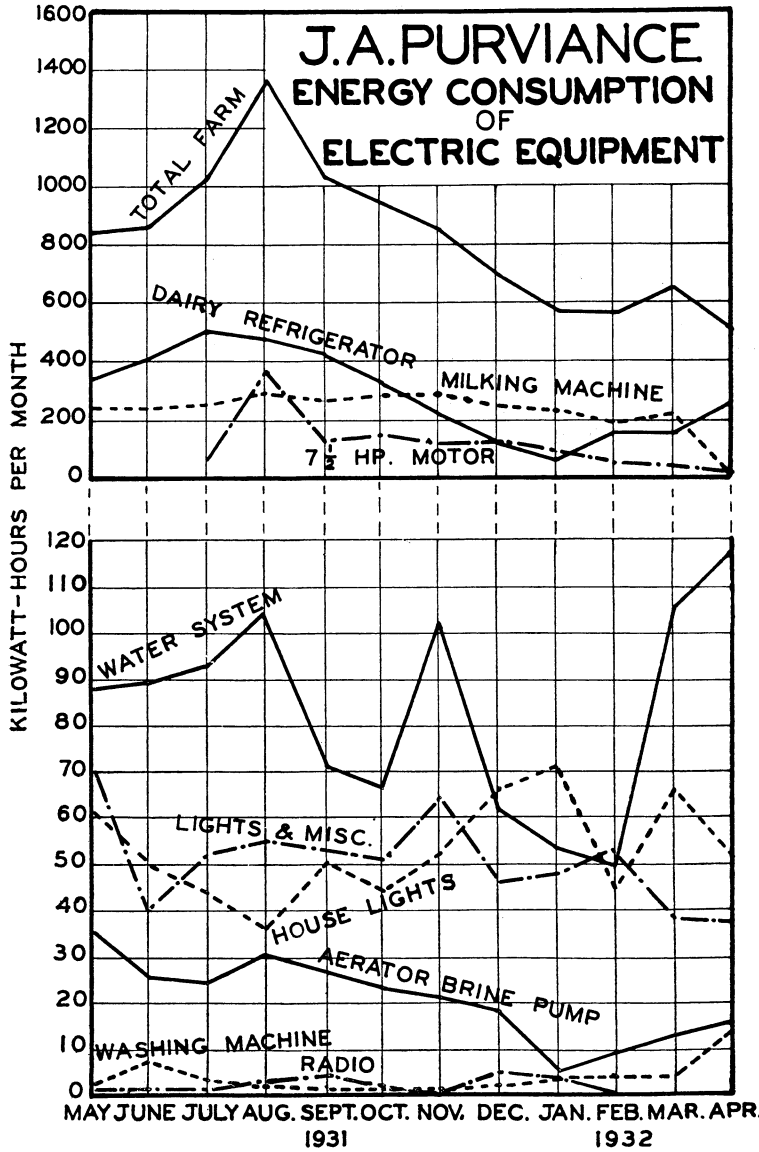
Farm Equipment: A 1 horsepower motor is used on a deep well, pressure water system for supplying running water to the houses, barn, poultry house, and barnyard. Electric equipment used in the dairy is dairy refrigerator, milking machine, aerator brine pump, and bottle washer. A 7½ horsepower motor is used to drive a feed grinder, an ensilage cutter, and a wood saw. A ¼ horsepower portable motor is used for driving an emery wheel and for other odd jobs. The cost of this equipment when purchased was estimated to be $2,500. A truck is used as another source of power on the farm.

Livestock and Poultry: An inventory of July 28, 1931, gave 80 head of cattle, 15 horses and 100 chickens.

Crops: The 1931 production was 30 acres of corn, 10 acres of wheat, 50 acres of oats, 30 acres of alfalfa hay, 50 acres of cane, 43 acres of tame pasture, and 150 acres of blackjack pasture. All of the feed grown, and in addition some cottonseed meal purchased as supplement, was consumed by stock on the farm.



The radio set enjoyed in the J. A. Purviance home.


J.A.PURVIANCE
ENERGY CONSUMPTION
OF
ELECTRIC EQUIPMENT
KILOWATT-HOURS PER MONTH
1600
1400
1200
1000
800
600
400
200
0
TOTAL FARM
DAIRY REFRIGERATOR
MILKING MACHINE
7½ HP. MOTOR
120
110
100
90
80
70
60
50
40
30
20
10
0
WATER SYSTEM
LIGHTS & MISC.
HOUSE LIGHTS
AERATOR BRINE PUMP
WASHING MACHINE
RADIO
MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.
1931
1932

J. A. Purviance

Monthly Kilowatt-hour Consumption of Electric Equipment From April, 1931, to May, 1932.

Month	Total kw-hr.	Dairy refrigerator	Aerator brine pump	Milking machine	7½ hp. motor	Water systems	House lights	Radio	Washing machine	Lights and misc.
May	843	346	35	240		88	61	1	2	70*
June	863	410	25	241		89	50	1	7	40*
July	1033	505	24	261	60	93	44	1	3	52
August	1363	478	30	292	363	104	36	3	2	55
September	1031	432	26	265	129	71	50	4	1	53
October	946	328	23	283	148	66	44	2	1	51
November	856	215	21	286	115	102	52	0	1	64
December	695	125	18	248	123	62	66	5	2	46
January	578	66‡	5‡	231	96	53	71	4	4	48
February	568	160‡	9‡	193	56	49	44	0	4	53
March	658	162‡	13‡	225	45	105	66	0	4	38
April	512	248	15	14†	17	117	51	0	13	37
TOTAL	9946	3475	244	2769	1152	999	635	21	44	607
Average	828.8	352‡	24.7‡	250.2	115.2	83.2	53	2.6	3.7	50.6

J. A. Purviance

Monthly Energy Consumption Cost of Electric Equipment From April, 1931, to May, 1932.

Month	Total cost	Average cost per kw-hr.	Dairy refrigerator	Aerator brine pump	Milking machine	7½ hp. motor	Water system	House lights	Radio	Washing machine	Lights and misc.
May	$34.54	4.10¢	$14.18	$1.43	$9.83	$0.00	$3.61	$2.50	$0.04	$0.08	$2.87*
June	35.17	4.08	16.71	1.02	9.82	0.00	3.63	2.04	0.04	0.28	1.63*
July	40.52	3.92	19.81	0.94	9.84	2.35	3.65	1.73	0.04	0.12	2.04
August	50.92	3.74	17.86	1.12	10.91	13.56	3.89	1.34	0.11	0.07	2.06
September	40.46	3.92	16.95	1.02	10.40	5.06	2.79	1.96	0.16	0.04	2.08
October	37.78	3.99	13.10	0.92	11.30	5.91	2.64	1.76	0.08	0.04	2.03
November	34.95	4.08	8.78	0.86	11.68	4.70	4.16	2.12	0.00	0.04	2.61
December	29.88	4.30	5.37	0.77	10.66	5.29	2.67	2.84	0.21	0.09	1.98
January	26.19	4.53	2.99‡	0.23‡	10.47	4.35	2.40	3.22	0.18	0.18	2.17
February	25.87	4.55	7.29‡	0.41‡	8.79	2.55	2.23	2.01	0.00	0.18	2.41
March	28.71	4.36	7.07‡	0.57‡	9.82	1.96	4.58	2.88	0.00	0.17	1.66
April	24.11	4.71	11.68	0.71	0.66†	0.80	5.51	2.40	0.00	0.61	1.74
TOTAL	$409.10		$141.79	$10.00	$114.18	$46.58	$41.76	$26.80	$0.86	$1.90	$25.18
Average	34.09	4.11¢	14.37‡	1.01‡	10.31	4.65	3.48	1.23	0.11	0.16	2.11

* Feed grinder included.

† Machine operated only 2 days during the month; this was compensated for in computing monthly average.

‡ The refrigerator and aerator were operated only 3 days in January, 7 days in February, and 17 days in March; this was compensated for in computing averages.

Connected load in kilowatts: lights 1.25, equipment 18.47, total 19.72.

The water system furnishes water from a 168-foot well for an average of 5 people, 12 horses, 63 head of cattle, and 190 chickens and in addition water for washing out dairy barn and milk house and for the watering of flowers.

House lights include poultry house lights, garage lights, waffle iron, vacuum cleaner, corn popper, 2 unit hot plate, reflector heater, iron, and toaster.

"Lights and misc." include tenant house lights, barn lights, granary lights, bottle washer, and a ¼ horsepower motor.

The radio is an 8-tube 90-watt set.

J. A. Purviance
Dairy Refrigerator Record From April, 1931, to May, 1932.

Month	Total* kw-hr.	Total* cost	Pounds of milk cooled	Average lbs. in storage continuously	Kw-hr. per 100 pounds cooled	Cost per 100 pounds cooled
May	381	$15.61	16,800	271	2.27	9.29¢
June	435	17.73	14,190	197	3.07	12.49
July	529	20.75	14,660	213	3.61	14.15
August	508	18.98	13,330	187	3.81	14.24
September	458	17.97	12,900	179	3.55	13.93
October	351	14.02	12,000	80	2.93	11.68
November	236	9.64	10,970	272	2.15	8.79
December	143	6.14	11,200	273	1.28	5.48
January	71†	3.22†	850†	213	8.35†	37.88†
February	169‡	7.70‡	2,710‡	290	6.24‡	28.41‡
March	175§	7.64§	5,700§	232	3.07§	13.40§
April	263	12.39	9,290	125	2.83	13.34
TOTAL	3,719	$151.79	124,000			
Average	377£	15.38£	12,628£	211	2.98	12.18¢

* Aerator brine pump included.

† The machine was run only 3 days during the month and this for the cooling of meat.

‡ The machine was used only 7 days during the month.

§ The machine was used 17 days during the month.

£ During January, February and March the machine ran only part of the time; this was compensated for in computing averages.

Average temperature of cooled milk, 36°F.

Average temperature of refrigerator box, 37°F.

Average pounds of milk cooled per day, 413.

Average time required for cooling per day, 2 hrs. and 40 min.

System of cooling: brine, with aerator and walk-in type box.

A 50-gallon per hour two section aerator was used for the cooling; water from the well was pumped through the upper section and brine circulated through the lower section.

Size of box 5x6x6 feet.

Gallons of brine stored in box, 375.

Storage space, 130 cu. ft.

The compressor is an air-cooled, methyl chloride, ½-ton unit driven by a 1 horsepower motor.

The aerator brine pump consists of a rotary pump driven by a ¼ horsepower motor.

J. A. Purviance

Milking Machine Record From April, 1931, to May, 1932.

Month	Kw-hr.	Cost	Total pounds milk	Kw-hr. per 1000 pounds milk	Number cows milked	Kw-hr. per cow per mo.	Cost per cow per mo.
May	240	$9.83	14,660	16.4	27	8.89	36.4¢
June	241	9.82	16,770	14.4	34	7.09	28.9
July	251	9.84	18,660	13.4	32	7.84	30.8
August	292	10.91	20,000	14.6	38	7.68	28.7
September	265	10.40	12,900	20.5	35	7.57	29.7
October	283	11.30	12,000	23.6	30	9.43	37.7
November	286	11.68	10,970	26.1	32	8.94	36.5
December	248	10.66	11,200	22.1	30	8.27	35.5
January	231	10.47	8,800	26.3	20	11.55	52.4
February	193	8.79	12,470	15.5	25	7.72	35.2
March	225	9.82	13,330	14.7	24	9.38	40.9
April	14*	0.66*	950	16.9	24	8.75*	41.2*
TOTAL	2,769	$114.18	152,710				
Average	250.2	10.31	13,799	18.1	29.7	8.43	34.7¢

* Machine was operated for only 2 days during the month; this was compensated for in computing average and unit values.

Average cost per 1000 lbs. of milk, 74.8 cents.

Average time required per day for milking, 3 hours and 30 minutes.

The machine is a 6-unit, of the pipe line type, equipped with vacuum pulsator and driven by a 3 horsepower motor.

This machine was not run to full capacity; there were never more than three units used, and a large part of the time only two units were used.

7½ Horsepower Motor, Record of Feed Grinding and Ensilage Cutting From June, 1931, to May, 1932.

Month	Total kw-hr.	Total cost	POUNDS OF FEED GROUND				Kw-hr. per 100 lbs. feed	Cost per 100 lbs. feed
			Oats	Sheaf wheat	Sheaf oats	Total		
July	60	$2.35			3,980	3,980	1.51	5.90¢
August	363**	13.56**			6,500	6,500	1.09	4.08
September	129**	5.06**			6,300	6,300	1.19	4.67
October	148*	5.91*			6,500	6,500	1.77	7.06
November	115	4.70			14,400	14,400	0.80	3.26
December	123†	5.29†			9,300	9,300	0.89	3.84
January	96†	4.35†			8,370	8,370	0.97	4.38
February	56	2.55	895	5,370		6,265	0.89	4.07
March	45	1.96		5,200		5,200	0.87	3.77
April	17‡	0.80‡	600§	540		1,140	0.88	4.12
TOTAL	1,152	$46.53		11,110	55,350	67,955		
Average	115.2	4.65				6,795	1.05	4.33¢

* 20 tons of ensilage was cut during the month the consumption of which was estimated at 33 kw-hr. for computing the unit cost of grinding.

† Eight cords of wood were sawed into stove length during December, and 3 cords during January. The energy consumption was estimated at 5 kw-hr. per cord for the purpose of computing unit grinding costs.

‡ The motor was run about 4 hours for pumping water out of the silo. The energy consumption was estimated at 7 kw-hr. in computing unit values for feed grinding.

§ A mixture of oats, alfalfa and corn.

** 177 tons of ensilage was cut in August with an energy consumption of 292 kw-hr., and 33 tons in September with a consumption of 54 kw-hr. The 210 tons of corn and sorghum ensilage was thrown into a pit silo, the sides of which extend about 10 feet above the ground. The total energy required was 346 kw-hr. at a cost of $13.03. The energy required per ton was 1.65 kw-hr. at a cost of 6.2 cents. The machine used for cutting was of the fly-wheel type, with a 13-inch throat.

During July, August, September and October a large hammer type forage mill was used for grinding; from then on a small hammer type mill equipped with cob crusher was used.

J. A. Purviance

Washing Machine Record From April, 1931, to May, 1932.

Month	Kw-hr.	Cost	Machines of dry clothes	Kw-hr. per 10 machines	Cost per 10 machines
May	2	$0.08	11	1.82	7.27¢
June	7*	0.28*	13	1.54	6.15
July	3	0.12	16	1.88	7.50
August	2	0.07	13	1.54	5.38
September	1	0.04	8	1.25	5.00
October	1	0.04	9	1.11	4.44
November	1	0.04	6	1.67	6.67
December	2	0.09	15	1.33	6.00
January	4†	0.18†	12	1.67	7.50
February	4†	0.18†	8	1.25	5.63
March	4†	0.17†	10	2.00	8.50
April	13*	0.61*	17	1.76	8.24
TOTAL	44	$1.90	138		
Average	1.83	0.08	11.5	1.29	6.59¢

* During June and April the waffle iron was used on the washing machine meter. The consumption of the iron was estimated at 5 kw-hr. for June and 10 kw-hr. for April. These values were subtracted from the total in computing average and unit consumption.

† During January, February and March the toaster was used on the meter. The consumption of the toaster was estimated at 2 kw-hr. for January, 3 kw-hr. for Februabry and 2 kw-hr. for March. These values were subtracted in computing average and unit consumption.

Average number of people washed for, 4.
Average kilowatt-hours per person per month, 0.46.
Average cost per person per month, 1.90 cents.
Average time required for washing per month, 6 hours.
The machine has a capacity of 6 sheets. It is of the gyrator type, equipped with power wringer and is driven by a ¼ horsepower motor.

CHARLES H. RODIECK—POULTRY FARM AND HATCHERY

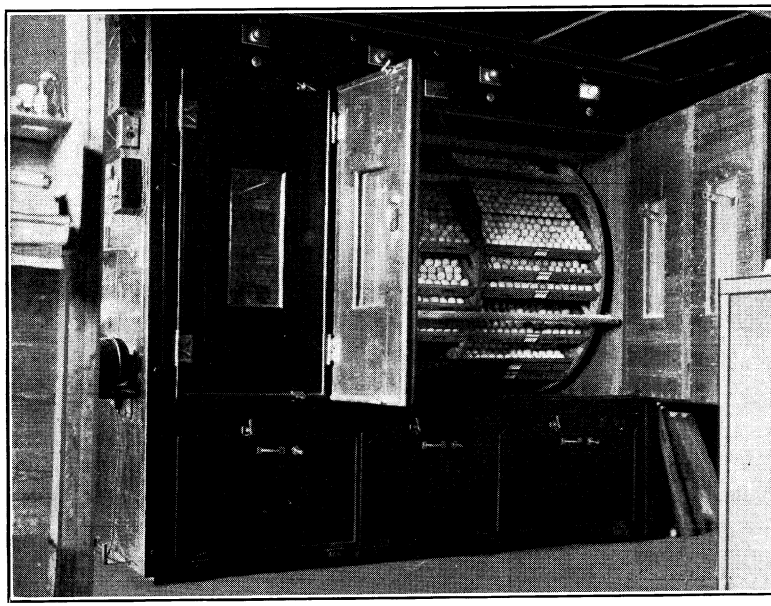
General Facts: Mr. Charles H. Rodieck's address is Sand Springs, Oklahoma. The farm is located ½ mile west and 2 miles south of Sand Springs. It is a poultry farm with 15 acres of land taken up with improvements, fruit and garden. The farm income is derived from custom hatching, and from the sale of chicks and fryers, with the addition of some fruit and truck sales. The hatchery has an incubator capacity of around 19,000 eggs and is operated throughout the entire year. The farm is owned, managed and operated by Mr. Rodieck and family. The family residing in the home consist of Mr. and Mrs. Rodieck, 2 daughters, and Mrs. Rodieck's mother. One hired man is kept the year round and extra help hired when needed. The farm is supplied electricity from a 2300 volt primary line

through a 7½ kva. transformer. A 110-220 volt, 3-wire service is run from the transformer to a 60 ampere entrance switch. The connected load consists of 2.4 kw. in lights and 5.45 kw. in equipment, a total of 7.85 kw. The farm wiring and fixtures were installed at a cost of around $150.

The Home: The residence is a 6-room stone structure equipped with electric lights, running water and sewage disposal system. A wood and coal stove is used for heating during the winter months. Electric conveniences used in the home other than lights are vacuum cleaner, 3 portable fans and flat iron. The cost of this equipment when purchased was estimated to be $85.

Tenant Houses: One house is located on the farm in addition to the home residence. It is a three-room wooden structure equipped with electric lights. An electric flat iron is used as an extra convenience.

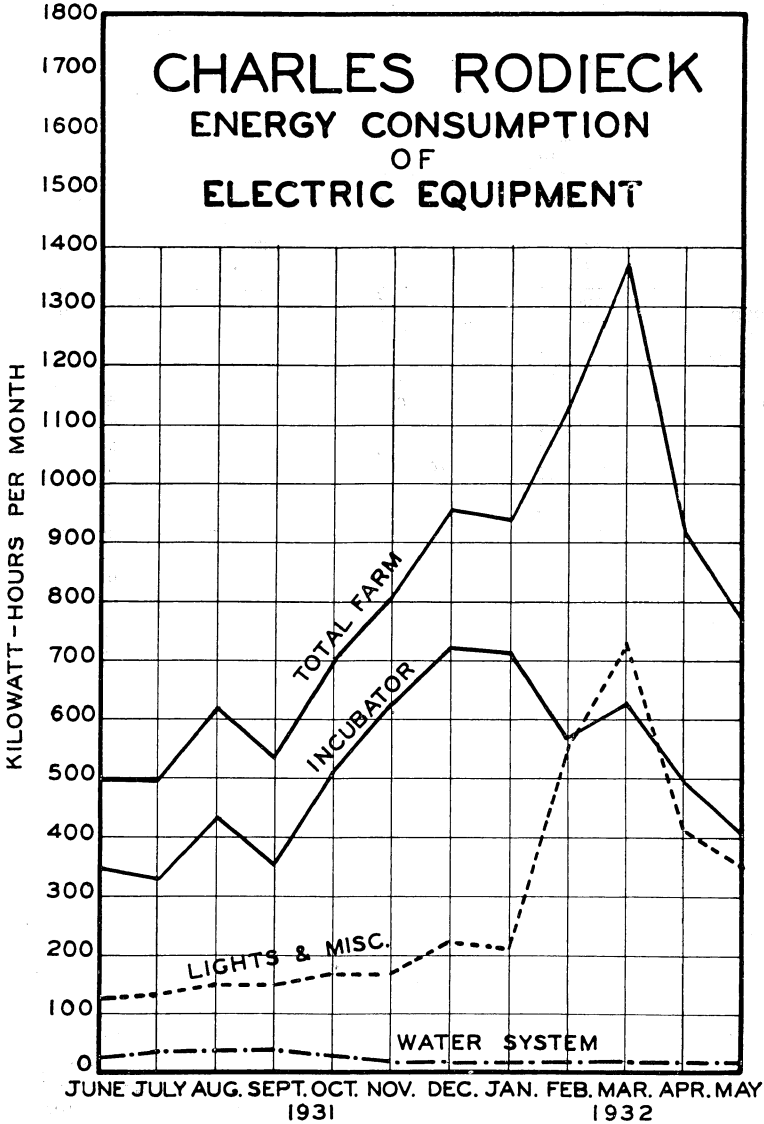
Farm Buildings: The improvements other than residences consist of 11 small brooder houses, one large brooder house, stone poultry house, incubator house, and stone gasoline filling station. The poultry house, brooder house, incubator house, and filling station are equipped with lights and are supplied with running water. The small brooder houses are supplied with float regulated water pans, and automatically heat controlled oil burning brooder stoves.



Mr. Charles H. Rodieck's 16,000-egg electric incubator that was operated throughout the year and hatched 84 per cent of the fertile eggs, at a cost of $1.64 per 1000 eggs incubated.

Farm Equipment: The electric equipment used outside the home consists of 8 electric incubators and two water systems. Three of the incubators have capacities of 16,000 eggs, 600 eggs, and 200 eggs respectively, the other five have capacities of 500 eggs each. One of the water systems is a modern pressure system that supplies running water to the house and other buildings. The other system consists of a motor and pump jack that

pumps water into a small slightly elevated tank; since the installation of the modern system it is used only as a standby. The cost of the equipment when purchased was estimated to be $3,000.



Poultry and Livestock: An inventory of September 8, 1931, showed 4,000 chickens, and two horses. The eggs used for hatching were not laid by hens on the farm but were purchased from regular farm customers over the state whose flocks are under the supervision of Mr. Rodieck.

Crops: The 1931 production was 8 acres of fruit and berries and 1 acre of gardens. The fruit, berries and garden not used by the family were sold as a cash crop. All of the feed required by poultry and stock was purchased since none was grown on the farm.

Charles H. Rodieck—Poultry Farm and Hatchery

Monthly Kilowatt-hour Cosumption of Electric Equipment
From May, 1931, to June, 1932.

Month	Total kw-hr.	Incubator	Water system	Lights and misc.
June	495	345	26	124
July	493	327	33	133
August	614	432	34	148
September	533	352	33	148
October	702	509	27	166
November	804	622	17	165
December	951	719	15	217
January	935	710	17	208
February	1130	565	15	550
March	1372	626	18	728
April	913	491	15	407
May	763	400	16	347
TOTAL	9705	6098	266	3341
Average	809	508	22	279

Monthly Energy Consumption Cost of Electric Equipment
From May, 1931, to June, 1932.

Month	Total bill	Average cost kw-hr.	Incubator	Water system	Lights and misc.
June	$22.85	4.62¢	$15.93	$1.20	$5.72
July	22.79	4.62	15.12	1.52	6.15
August	26.42	4.30	18.59	1.46	6.37
September	23.99	4.50	15.84	1.49	6.66
October	29.06	4.14	21.07	1.12	6.87
November	32.12	4.00	24.85	0.68	6.59
December	36.53	3.84	27.62	0.58	8.33
January	36.05	3.86	27.38	0.65	8.02
February	41.90	3.71	20.95	0.56	20.39
March	49.16	3.58	22.43	0.65	26.08
April	35.39	3.88	19.03	0.58	15.78
May	30.89	4.05	16.19	0.65	14.05
TOTAL	$387.15		$245.00	$11.14	$131.01
Average	32.26	3.99¢	20.42	0.93	10.92

Connected load in kilowatts: lights 2.4, equipment 5.45, total 7.85.

The water system furnishes water from a 207-foot well for an average of 10 people, 2 horses, and 5600 young chickens and ducks, and in addition water for a gasoline filling station and for washing of incubator trays.

"Lights and miscellaneous" include the lights of 2 houses, poultry house, brooder house, incubator house, and gasoline filling station; 2 flat irons, vacuum cleaner, 3 portable fans, and during the spring of the year one 200-egg incubator, one 600-egg incubator and five 500-egg incubators.

Charles H. Rodieck—Poultry Farm and Hatchery
Incubator Records From May, 1931, to June, 1932.

Month	Kw-hr.	Cost	Eggs set	Eggs candled out	Chicks hatched during month	Per cent of fertile eggs hatched
June	345	$15.93	11,022	2,652	4,975	59.4*
July	327	15.12	9,801	1,648	5,614	68.9*
August	432	18.59	13,308	3,045	5,030	49.0†
September	352	15.84	8,630	1,297	6,160	84.0
October	509	21.07	10,138	2,456	6,314	82.2†
November	622	24.85	10,659	1,987	7,935	91.5
December	719	27.62	8,333	1,531	6,314	92.8
January	710	27.38	13,827	2,145	10,369	88.7
February	565	20.95	11,496	1,281	9,155	89.6
March	626	22.43	16,663	1,390	14,106	92.4
April	491	19.03	17,875	1,500	15,288	93.4
May	400	16.19	17,722	1,538	15,448	95.4
TOTAL	6,098	$245.00	149,476	22,470	106,708	
Average	508	20.42	12,456	1,872	8,892	84.01

* The eggs set were not taken care of during the hot weather.

† The automatic heat control failed to operate and allowed the temperature to run up to 110° in August and to 107° in October on part of the eggs.

Kilowatt-hours required per 1000 eggs incubated, 40.8.

Cost of electricity per 1000 eggs incubated, $1.64.

Kilowatt-hours required per 1000 chicks, 57.14.

Cost of electricity per 1000 chicks hatched, $2.30.

A 16,000-egg, cabinet type, electrically heated and ventilated incubator was used, the connected load of which was 2.2 kilowatts. The incubator temperature was regulated by thermostatic control at 100° to 101°F. During cold weather room temperature was held at around 70°F. In warm weather the room temperature varied with the temperature of the outside air.

PETER J. SCHMALTZ

General Facts: Mr. Peter J. Schmaltz's address is Morrison, Oklahoma. The farm is located 2½ miles west of Morrison. It is a general farm of 370 acres of land, 210 acres owned by Mr. Schmaltz and the other 160 acres leased by him. The farm income is derived from the sale of grain, cattle and hogs, with the aid of poultry and produce sales. The farm is managed and operated by Mr. Schmaltz and family. The family at home consists of Mr. and Mrs. Schmaltz and son. One hired man residing in the home is kept the year round and extra help hired during harvest. The farm is served electricity from a 4000 volt primary line through a 5 kva. transformer. A 110-220 volt 3-wire service is run from the transformer to a 60 ampere entrance switch. The connected load consists of 1.32 kw. in lights and 12.95 kw. in equipment, a total of 14.27 kw. The wiring and fixtures for the farm were installed at a cost of around $275.

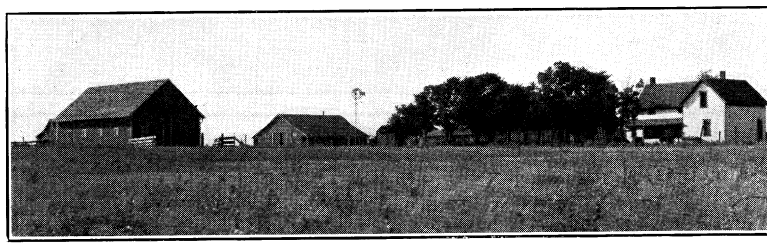
The Home: The house is a two-story wooden structure of six rooms. It is equipped with electric lights, running water, and kitchen sink. A wood and coal stove is used for heating during the winter months. Electric conveniences used in the home other than lights are electric range, refrigerator, washing machine, radio, flat iron, waffle iron, toaster, percolator, and pressure water system that supplies running water to the house and poultry house from the cistern. The cost of this equipment when purchased was estimated to be $925.

Farm Buildings: The improvements besides the house consist of horse barn, cow barn, poultry house, wash house, shop, and garage. All of these buildings are wired for and equipped with lights.

Farm Equipment: The electric equipment consists of a 416-egg electric heat, natural draft incubator and a 3 horsepower motor used for driving a small hammer mill and small cylinder type feed cutter. The cost of this equipment when purchased was estimated to be $475.

Livestock and Poultry: An inventory of July 29, 1931 gave 30 head of cattle, 8 horses, 5 hogs and 400 chickens.

Crops: The 1931 production was 20 acres of corn, 70 acres of wheat, 70 acres of oats, 4 acres of kafir, 20 acres of alfalfa, 14 acres of prairie hay, and 140 acres of wild pasture. A part of the crops grown was fed to stock on the farm and the remainder sold as a cash crop.



A general view of the Peter J. Schmaltz farm on which liberal use is made of electric equipment.

Peter J. Schmaltz

Monthly Kilowatt-hour Consumption of Electric Equipment From April, 1931, to May, 1932.

Month	Total kw-hr.	Electric range	House refrig-erator	Water system	Radio	Washing machine	House lights	Incubator	Feed grinder	Lights and misc.
May	188	68	31	0	7	3	14	51	4	10
June	265	179	49	1	5	3	7	12	4	5
July	248	151	61	1	7	4	11	0	6	7
August	261	168	52	2	8	3	11	0	9	8
September	242	141	58	1	6	3	13	0	13	7
October	215	111	40	1	7	2	18	0	24	12
November	109	16	24	1	8	3	18	0	23	16
December	104	2	18	1	12	3	22	0	28	18
January	99	1	15	1	13	2	22	0	25	20
February	144	0	16	1	10	3	17	55	24	18
March	161	1	16	1	12	2	21	59	26	23
April	211	9	31	1	8	3	18	81	43	17
TOTAL	2247	847	411	12	103	34	192	258	229	161
Average	187	154†	34	1	8.6	2.8	16	64.5*	19	13.4

Peter J. Schmaltz

Monthly Energy Consumption Cost of Electric Equipment From April, 1931, to May, 1932.

Month	Total bill	Average cost per kw-hr.	Electric range	House refrig-erator	Water system	Radio	Washing machine	House lights	Incu-bator	Feed grinder	Lights and misc.
May	$12.68	6.74¢	$4.59	$2.09	$0.00	$0.47	$0.20	$0.94	$3.44	$0.27	$0.68
June	15.10	5.70	10.20	2.79	0.06	0.28	0.17	0.40	0.68	0.23	0.29
July	14.57	5.88	8.87	3.58	0.06	0.41	0.24	0.65	0.00	0.35	0.41
August	14.98	5.74	9.64	2.98	0.12	0.46	0.17	0.63	0.00	0.52	0.46
September	14.38	5.94	8.38	3.45	0.06	0.36	0.18	0.77	0.00	0.77	0.41
October	13.53	6.29	6.99	2.52	0.06	0.44	0.13	1.13	0.00	1.51	0.75
November	10.19	9.35	1.50	2.24	0.09	0.75	0.28	1.68	0.00	2.15	1.50
December	10.03	9.64	0.19	1.74	0.10	1.16	0.29	2.12	0.00	2.70	1.73
January	9.87	9.97	0.10	1.50	0.10	1.30	0.20	2.19	0.00	2.49	1.99
February	11.29	7.84	0.00	1.26	0.08	0.78	0.24	1.33	4.31	1.88	1.41
March	11.83	7.35	0.07	1.18	0.07	0.88	0.15	1.54	4.34	1.91	1.69
April	13.40	6.35	0.57	1.97	0.06	0.51	0.19	1.14	5.15	2.73	1.08
TOTAL	$151.85		$51.10	$27.30	$0.86	$7.80	$2.44	$14.52	$17.92	$17.51	$12.40
Average	12.65	6.76¢	9.29†	2.28	0.07	0.65	0.20	1.21	4.48*	1.46	1.03

* Based on 4 months' operation.

† Based on 5½ months' operation.

Connected load in kilowatts: lights 1.32, equipment 12.95, total 14.27.

The water system furnishes water from a 12-foot cistern, for the house use of 4 people and for the watering of around 300 small chicks in the spring and summer.

The house refrigerator has a capacity of 7 cu. ft.

The radio is a 75-watt 7 tube set.

House lights include wash house lights, one yard light, flat iron, toaster, waffle iron and percolator.

"Lights and misc." include horse barn lights, cattle barn lights, poultry house lights, and yard lights.

Peter J. Schmaltz
Electric Range Record From April, 1931, to May, 1932.

Month	Kw-hr.	Cost	Number people	Total meal units	Kw-hr. per 100 meal units	Cost per 100 meal units
May	68*	$4.59*	4	84*	81	$5.46
June	179	10.20	4	378	47.4	2.70
July	151	8.87	4	372	40.6	2.38
August	168	9.64	5	456	36.8	2.14
September	141*	8.38*	4	324*	43.5	2.59
October	111*	6.99*	4	300*	37.0	2.33
November	16*	1.50*	4	32*	50.0	4.69
December	2*	0.19*	4	4*	50.0	4.75
January	1	0.10		†		
February	0	0.00				
March	1	0.07		†		
April	9*	0.57*	5	20*	45.0	2.85
TOTAL	847	$51.10		1970		
Average	154*	9.29*	4*	358*	43.0	$2.59

* During May, September, October, November, December and April the range was not used every day of the month. In compensating for the days not used the results show that the range was used 5½ months during the year for an average of 4 people; this value was used in computing monthly averages.
† Some baking done.

Average kilowatt-hours per person per month, 38.5.
Average cost per person, per month, $2.32.
Average time used per day, 3 hrs. and 30 min.
During the season the range was used, a large amount of canning was done, for example, in the month of June 120 quarts of fruit and vegetables were canned.
The range has a connected load of 6700 watts distributed between three plates and an oven.

Washing Machine Record From April, 1931, to May, 1932.

Month	Kw-hr.	Cost	Machines of dry clothes	Kw-hr. per 10 machines	Cost per 10 machines
May	3	$0.20	17	1.76	11.8¢
June	3	0.17	21	1.43	8.1
July	4	0.24	22	1.82	10.9
August	3	0.17	17	1.76	10.0
September	3	0.18	21	1.43	8.6
October	2	0.13	16	1.25	8.1
November	3	0.28	16	1.88	17.5
December	3	0.29	16	1.88	18.1
January	2	0.20	19	1.05	10.5
February	3	0.24	20	1.50	12.0
March	2	0.15	18	1.11	8.3
April	3	0.19	24	1.25	7.9
TOTAL	34	$2.44	227		
Average	2.8	0.20	18.9	1.50	10.7¢

Number of people washed for, 4.
Average kilowatt-hours required per person, per month, 0.71.
Average cost per person per month, 5.1 cents.
Average running time of machine per month 7½ hours.

A six-sheet capacity gyrator type machine equipped with power wringer and driven by a ¼ horsepower motor was used for the washing.

Peter J. Schmaltz

Electric Incubator Record For 1931 and 1932 Hatching Seasons

Month of setting	Kw-hr. per hatch	Number eggs set	Number eggs candled out	Number chicks hatched	Per cent of fertile eggs hatched	Kw-hr. per 1000 eggs incubated	Kw-hr. per 1000 chicks hatched
February	88	416	98	199	62.6	211.5	442.2
March	79	416	100	191	60.4	189.9	413.6
April	58	416	30	342	88.6	139.4	169.6
May	48	416	55	280	77.6	115.4	171.4
February	76	416	78	234	69.2	182.7	324.8
March	74	416	140	179	64.9	177.9	413.4
April	52	416	89	158	48.3	125.0	329.1
May	49	416	69	187	53.9	117.8	262.0
TOTAL	524	3328	659	1770			
Average	65.5	416	82.4	221.3	66.3	157.4	296

Cost of power required for two seasons, $35.99.
Average cost per hatch, $4.50.
Average cost per 1000 eggs incubated, $10.81.
Average cost per 1000 chicks hatched, $20.33.

Two 208-egg flat top, radiant heat, natural ventilated incubator units were used, the total connected load of which was 440 watts. The temperature within the incubator was maintained at 103°F. by thermostatic control.

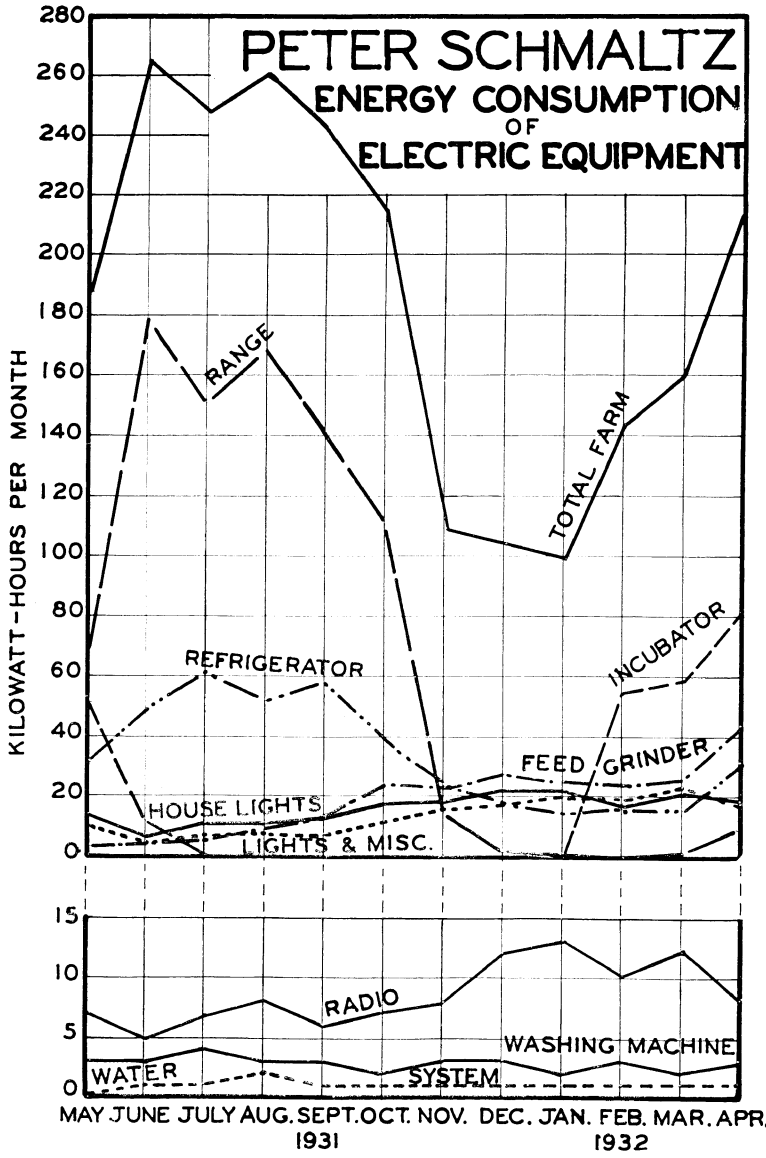
The incubators were located in the house on the second floor, in a room that was not heated, consequently the room temperature varied with the weather.

Feed Grinding Record From April, 1931, to May, 1932.

Month	Kw-hr.	Cost	POUNDS OF FEED				Kw-hr. per 100 lbs. feed	Cost per 100 lbs. feed
			Oats	Corn	Wheat	Total		
May	4	$0.27		336	360	696	0.57	3.88¢
June	4	0.23	96	392	240	728	0.55	3.16
July	6	0.35	255	447	480	1182	0.51	2.96
August	9	0.52	383	670	720	1773	0.51	2.93
September	13	0.77	1000	900	100	2000	0.65	3.85
October	24	1.51	1825	1630	150	3605	0.66	4.19
November	23	2.15	1788	1585	130	3503	0.66	6.14
December	28	2.70	2176	1344	240	3760	0.74	7.18
January	25	2.49	1250	1460		2710	0.92	9.19
February	24	1.88	1430	788		2218	1.08	8.48
March	26	1.91	1590	528		2118	1.23	9.02
April	43	2.73	1653	1108	258	3019	1.42	9.04
TOTAL	229	$17.51	13446	11188	2678	27312		
Average	19	1.46				2276	0.84	6.41¢

For a mixture of oats, corn and wheat, such as was generally ground, the rate of grinding was about 500 pounds per hour. The grain was ground with a ⅛″ and a ½″ screen, the ⅛″ screen being used the greater part of the time.

The grinding was done with a small hammer type mill equipped with elevating fan and dust collector, and driven by a 3 horsepower motor.



W. H. SHOOT—POULTRY FARM AND HATCHERY

General Facts: Mr. W. H. Shoot's address is R. F. D. No. 6, Guthrie, Oklahoma. The farm is located 1¾ miles south of Guthrie. It consists of 5 acres of land, most of which is taken up by improvements, garden and truck. The farm income is derived from custom hatching, and from the sale of chicks and fryers. The hatchery has an incubator capacity of 42,000 eggs and is operated for about 5 months of the year. The farm is owned, managed and operated by Mr. Shoot and family. The family at home consists of 8 people, Mr. and Mrs. Shoot, 3 sons and 3 daughters. One additional man is kept the year round and extra help hired when needed. Electricity is served the farm from a 2200 volt primary line through a 5 kva. transformer. A 110-220 volt 3-wire service is run from the transformer to a 60 ampere entrance switch. The connected load is 0.54 kw. in lights and 11.7 in equipment, a total of 12.24 kw. The cost of wiring the farm for lights and equipment was around $125.

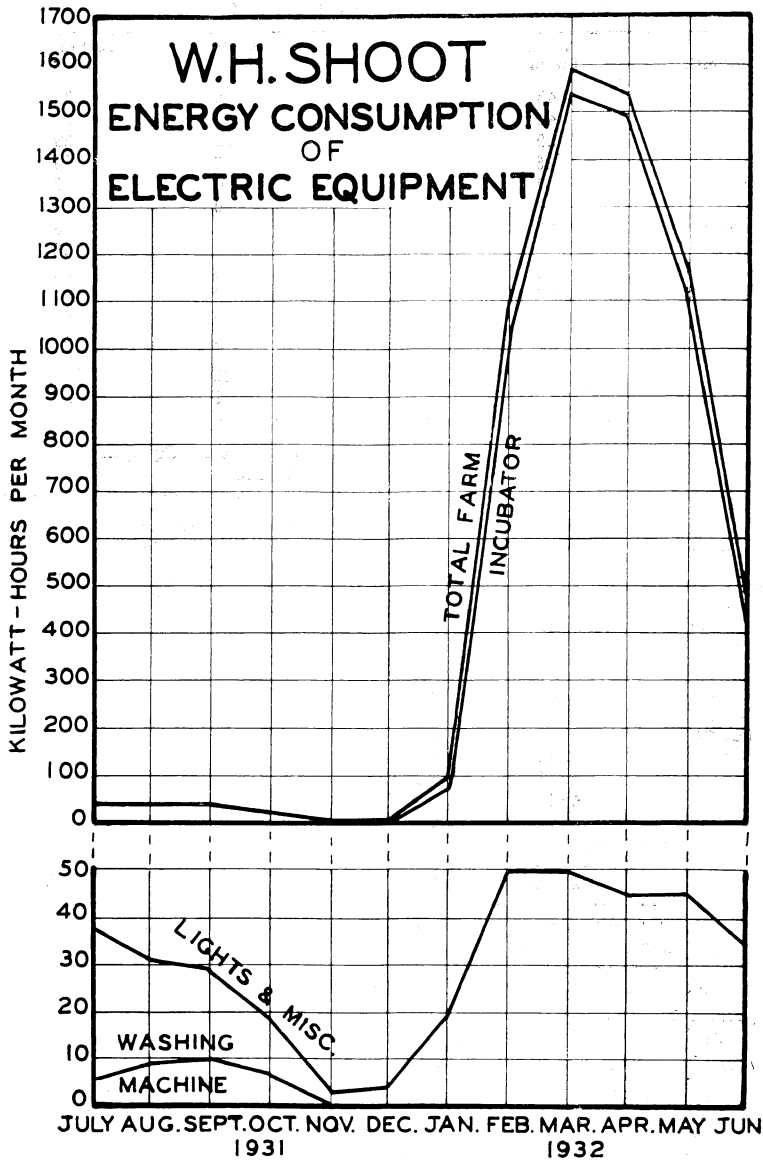
The Home: The house is an 11-room wooden structure equipped with the conveniences of natural gas lights, running water, and natural gas heat. An electric service run into the house is used for three electric lights and a flat iron. A washing machine, belonging to a friend, was used for a few months in the incubator house. The cost of this machine and flat iron when purchased was estimated to be $75.

Farm Buildings: The improvements, other than the house, consist of barn, garage and a combined incubator and brooder house. The combined incubator and brooder house is the only building wired for lights and equipment. This building is also supplied with natural gas heat and running water.

Farm Equipment: A pressure water system is used for supplying running water to the house and the incubator house. The electric hatchery equipment consists of two 17,000-egg and one 8000-egg electrically heated and ventilated incubators.

Poultry and Livestock: An inventory of September 1, 1931, gave two head of cattle and 150 chickens. The eggs used for hatching were not produced on the farm, but were purchased from farm customers.

Crops: The 1931 production was 1½ acres of corn and a small tract of garden and berries. The products grown were consumed on the farm or sold to customers near by. The feed required for chicks during the hatching season, and for other poultry and stock throughout the year was purchased.


W.H. SHOOT
ENERGY CONSUMPTION
OF
ELECTRIC EQUIPMENT
KILOWATT-HOURS PER MONTH
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
TOTAL FARM
INCUBATOR
50
40
30
20
10
0
LIGHTS & MISC.
WASHING
MACHINE
JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY JUNE
1931
1932

W. H. Shoot Poultry Farm

Monthly Kilowatt-hour Consumption of Electric Equipment
From June, 1931, to July, 1932.

Month	Total kw-hr.	Electric incubator	Washing machine	Lights and misc.*
July	43	0	6	37
August	40	0	9	31
September	39	0	10	29
October	26	0	7	19
November	3	0	0	3
December	4	0	0	4
January	93	74	0	19
February	1091	1041	0	50
March	1589	1539	0	50
April	1538	1493	0	45
May	1163	1118	0	45
June	487	452	0	35
TOTAL	6116	5717	32	367
Average	509.7	11.84†	8	30.6

Monthly Energy Consumption Cost of Electric Equipment
From June, 1931, to July, 1932.

Month	Total bill	Average cost per kw-hr.	Electric incubator	Washing machine	Lights and misc.*
July	$8.11	18.9¢		$1.13	$6.98
August	8.02	20.1		1.80	6.22
September	7.98	20.5		2.05	5.93
October	7.34	28.2		1.98	5.36
November	6.00	200.0			6.00
December	6.00	150.0			6.00
January	9.68	10.4	$7.70		1.98
February	41.12	3.77	31.24		1.83
March	56.81	3.58	55.02		1.79
April	55.20	3.59	53.58		1.62
May	43.39	3.73	41.71		1.68
June	22.10	4.54	20.51		1.59
TOTAL	$271.75		$217.76	$6.96	$47.03
Average	22.65	4.44¢	45.08†	1.74	3.92

* Estimated from the number of lights and hours burned per day.

† The incubator was operated only 2 days in January and 23 days in June. This was compensated for in computing monthly averages.

Connected load in kilowatts: lights 0.54, equipment 11.7, total 12.24.

"Lights and misc." include brooder and incubator house lights, a 1 hp. motor on water system, 3 house lights and flat iron.

The washing machine is of the gyrator type, equipped with power wringer and is driven by a ¼ hp. motor. It is used for an average of 21 people with a monthly energy consumption per person of 0.38 kw-hr. at a cost of 8.28 cents.

The average consumption per 10 batches dry clothes is 1.38 kw-hr. at a cost of 32 cents.

The average consumption per 100 pounds of clothes washed is 2.32 kw-hr. at a cost of 55 cents.

W. H. Shoot—Poultry Farm
Electric Incubator Record for 1932 Season.

Month	Kw-hr.*	Cost	Eggs set in month	Chicks hatched in month
January	74	$ 7.70	3,180	
February	1,041	39.24	25,529	5,074
March	1,539	55.02	27,352	19,935
April	1,493	53.58	34,308	18,513
May	1,118	41.71	19,764	14,700
June	452	20.51	1,452	10,075
TOTAL	5,717	$217.76	111,585	68,297
Average	1,184†	45.08†	23,102†	14,140†

* This meter was not calibrated by College standard.

† The incubator was operated only 2 days in January and 23 days in June. This was compensated for in computing monthly average.

Kilowatt-hours required for 1000 eggs incubated, 51.23.

Cost per 1000 eggs incubated, $1.95.

Kilowatt-hours required per 1000 chicks hatched, 83.7.

Cost per 1000 chicks hatched, $3.19.

Per cent of total eggs hatched, 61.2.

Three cabinet type incubators were used, the combined capacity of which is 42,000 eggs representing a connected load of 10.4 kw. Two of these are 17,000-egg machines while the third is an 8,000-egg machine. Each machine is electrically heated and ventilated. The temperature in the incubator is maintained by thermostatic control at 100 to 100.5°F. The incubator room temperature is kept around 70°F.

GEORGE SMITH—POULTRY FARM AND HATCHERY

General Facts: Mr. George Smith's address is R. F. D. No. 4, Broken Arrow, Oklahoma. The farm is located five miles east of Broken Arrow. Mr. Smith's property here consists of 80 acres of land with two sets of improvements. Seventy-two acres of the land with one set of improvements is rented to and farmed by a tenant farmer. The improvements on the rented acreage are located apart from Mr. Smith's home and are not supplied with electric service. For the purpose of this report, the rented property will not be considered a part of the farm. The remaining 8 acres of land is taken up by improvements, poultry lots and garden. It is managed and operated by Mr. Smith as a poultry farm and hatchery. One hired man is kept the year round and additional help hired when needed. The farm income is derived from custom hatching and from the sale of chicks and eggs. The hatchery has an incubator capacity of 15,000 eggs and is operated 3 or 4 months out of the year. Electricity is supplied the farm from a 6600 volt primary line through a 3 kva. transformer, and from a 1500 watt, 32 volt individual electric plant. The individual plant was in use before central station service was supplied and is now operated for brooder house lights and pressure water system, representing a connected load of 0.94 kw. A 110-220 volt 3-wire service is run from the transformer to a 60 ampere switch for supplying service to the remainder of the farm. The connected load off the transformer consists of 1.84 kw. in lights and 1.9 kw. in equipment, a total of 3.74 kw. The wiring for the farm was installed at a cost of around $100.00.

The Home: The home is a 2-room wooden structure equipped with electric lights, running water and natural gas heat. Conveniences used in

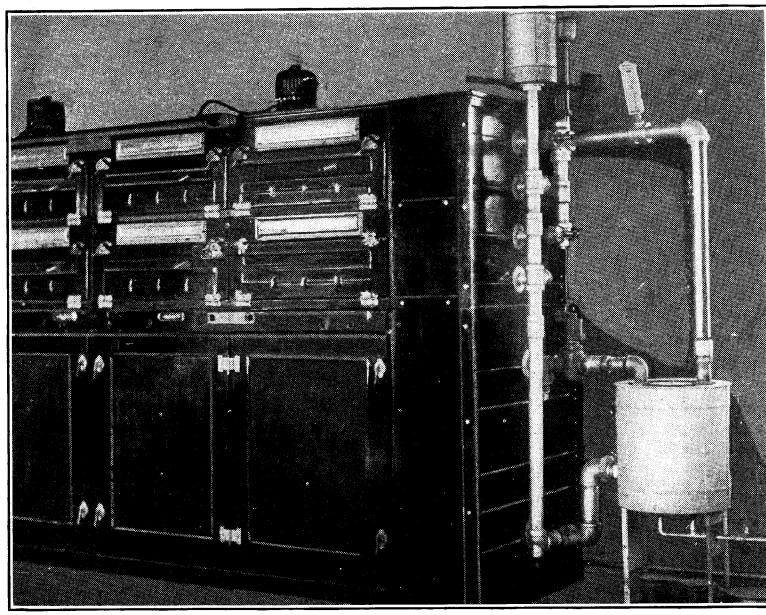
the home other than lights are radio and three portable fans. The cost of this equipment when purchased was estimated to be $150.

Farm Buildings: The home improvements in addition to the house are brooder house, 2 poultry houses and incubator house. All of the buildings are equipped with lights and running water. In addition to lights and water the brooder house and incubator house are supplied with natural gas heat.

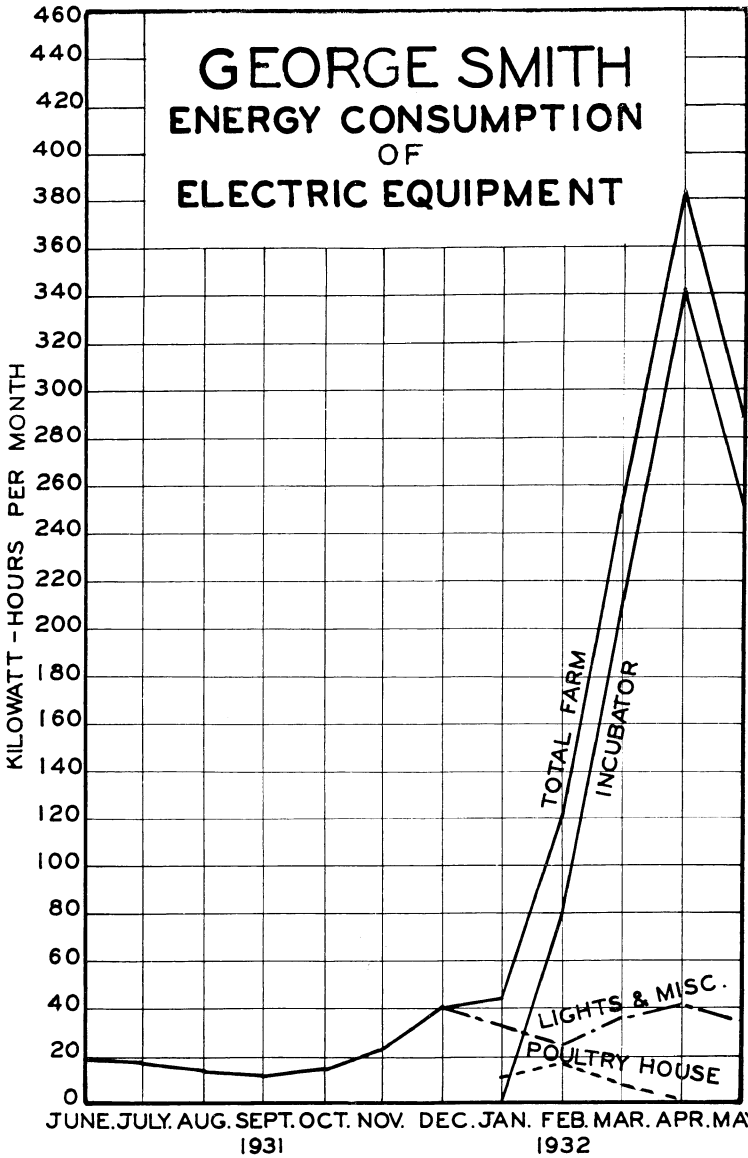
Farm Equipment: The electric equipment used outside the home consists of three 5,000-egg incubator units, egg candler, shallow well pressure water system, and 1500 watt, 32 volt individual lighting plant. The lighting plant furnishes power for the brooder house lights and for the pressure water system. The pressure water system supplies running water to the house and all other buildings.

Poultry and Livestock: An inventory of August 11, 1931, gave 400 chickens and one horse. The eggs produced on the farm during the hatching season are used for hatching; during the remainder of the year they are sold. The additional eggs required during the hatching season are purchased from farm customers.

Crops: The 1931 production was 2 or 3 acres of tame pasture for poultry and a small garden. The feed required by the poultry in addition to green pasture was purchased. The 1931 production of the rented land from which Mr. Smith received a share was 30 acres of corn and 30 acres of oats.



Mr. George Smith's 15,000-egg combination electric and hot water incubator that is used for home and custom hatching. To the right is shown the gas water heating equipment and boiler.


GEORGE SMITH
ENERGY CONSUMPTION
OF
ELECTRIC EQUIPMENT
KILOWATT-HOURS PER MONTH
460
440
420
400
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
TOTAL FARM
INCUBATOR
LIGHTS & MISC.
POULTRY HOUSE
JUNE. JULY. AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY.
1931
1932

George Smith—Poultry Farm and Hatchery

Monthly Kilowatt-hour Consumption of Electric Equipment From May, 1931, to June, 1932.

Month	Total kw-hr.	Incubator	Poultry house lights	Lights and misc.
June	19			19
July	17			17
August	14			14
September	11			11
October	14			14
November	23			23†
December	41			41†
January	44		11*	33†
February	122	80‡	17	25
March	257	213	8*	36
April	385	343		42
May	289	254		35
TOTAL	1236	890	36	310
Average	103	274	18*	26

Monthly Energy Consumption Cost of Electric Equipment From May, 1931, to June, 1932.

Month	Total bill	Average cost per kw-hr.	Incubator	Poultry house lights	Lights and misc.
June	$4.33	22.79¢			$4.33
July	4.19	24.65			4.19
August	3.98	28.43			3.98
September	3.77	34.27			3.77
October	3.98	28.43			3.98
November	4.61	20.04			4.61†
December	5.87	14.32			5.87†
January	6.08	13.82		$1.52*	4.56†
February	8.66	7.10	$5.68‡	1.21	1.77
March	12.71	4.95	10.53	0.40*	1.78
April	16.55	4.30	14.75		1.80
May	13.67	4.73	12.01		1.66
TOTAL	$88.40		$42.97	$3.13	$42.30
Average	7.37	7.15¢	13.22	1.57*	3.53

* The meter was set on the lights only 16 days in January and lights were used only part of the month of March; this is compensated for in the monthly average.

† Poultry house lights included.

‡ The incubator was used only 7 days during the month; this was compensated for in computing monthly average.

Connected load in kilowatts: lights 1.84, equipment 1.9, total 3.74.

Two 40-watt lights were used to light the 20x40 foot poultry house 4 hours each morning during the months of November, December, January, February and March for 90 hens. During cold weather two additional lights were used for water heater, while the lights were burning.

"Lights and misc." include house lights, incubator room lights, egg candler, and portable fan.

George Smith—Poultry Farm and Hatchery
Incubator Record for the 1932 Hatching Season

Month	Kw-hr.	Cost	Eggs set in month	Eggs candled out	Eggs hatched	Per cent of fertile eggs hatched
February	80*	$5.68*	1,065	175	620	69.7
March	213	10.53	5,486†	1,173	3,189	73.9
April	343	14.75	11,527‡	2,272	4,605	49.8£
May	254	12.01	512§	110	343	85.3
TOTAL	890	$42.97	18,590	3,730	8,757	
Average	274	13.22	5,720	1,148	2,694	58.9

* The incubator was used only 7 days during the month; this was compensated for in computing monthly averages.

† 256 duck eggs are included, of which 88 were candled out and 62 hatched.

‡ 1,078 duck eggs are included, of which 327 were candled out and 444 hatched, also 242 turkey eggs, of which 46 were candled out and 121 hatched.

§ 68 duck eggs are included, of which 33 were candled out and 18 hatched, also 90 turkey eggs, of which 28 were candled out and 38 hatched.

£ The low per cent hatch was due to low humidity caused by a faulty hygrometer.

Kilowatt-hours required per 1000 eggs incubated, 47.9.

Cost of electricity per 1000 eggs incubated, $2.31.

Kilowatt-hours required per 1000 chicks, 101.6.

Cost of electricity per 1000 chicks hatched, $4.91.

The incubators used were 3 cabinet type, 5000-egg units that were ventilated by electric fans and heated by electricity and hot water. The bulk of the heat was obtained from hot water heated by gas, while the final heat for regulation was obtained from electric elements controlled by a thermostat.

One ⅛ horsepower fan and one 300-watt heating element were used with each unit.

The incubator temperature was held at 101° and 102°F. and the room temperature kept between 70° and 80°F.

The gas consumption of the incubator for the season was estimated from the customer's gas bill to be 7000 cu. ft., the cost of which was $3.15.

STANDARD DAIRY

General Facts: The Standard Dairy is an incorporated farm located 8 miles east of Main Street and 2 miles south of 11th Street, Tulsa, Oklahoma. It consists of a dairy and meat packing plant with 630 acres of land. Of the land, 430 acres are owned by the corporation and the other 200 acres are leased to it. The farm income is derived from the sale of meat, milk and cream. The meat packing plant has a capacity for the killing and curing of about 150 hogs and 50 cattle per week. About 60 cows are milked throughout the year, and the milk, with that purchased, is pasteurized and retailed to customers in Tulsa. The farm was managed during the year by Mr. J. A. Bartlett and by Mr. Floyd Green. The dairy was supervised and operated during the year by three different men, Mr. Jess Crooks, Mr. W. M. Jackson and Mr. C. O. Coburn. The meat packing plant was in charge of Mr. R. O. Brooks. In addition to the above men, 13 hired men are kept the year round and extra help hired during rush seasons. The farm is supplied single phase and three phase electricity from a 2300 volt primary through three 25 kva. transformers. A 220 volt 3-phase service is run from the transformers to a 400 ampere switch for power, and a 110-220 volt 3-wire service is run from the transformers to a 60 ampere switch for lights. The connected load consists of 6.36 kw. in lights and 157.5 kw. in equipment, a total of 163.86 kw.

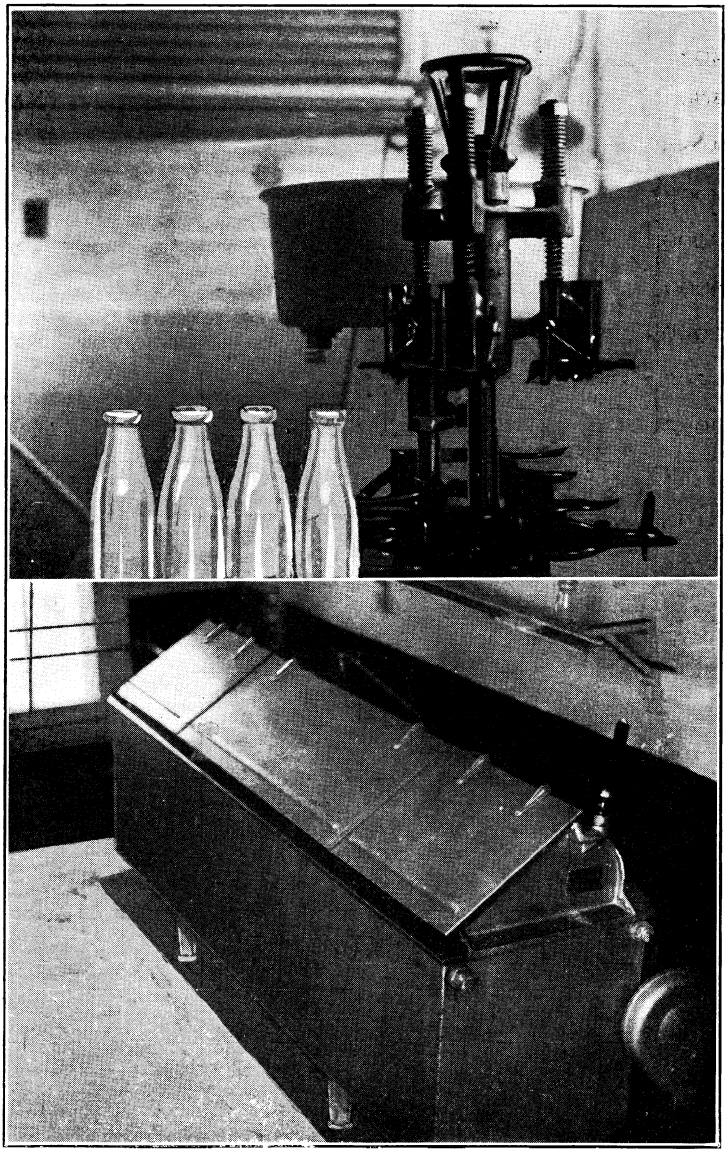
Farm Residences: Five homes are located on the farm for the residences of hired men and their families. These houses are wooden structures equipped with electric lights, running water, sewage disposal, and natural gas heat, and consist of one 5 room house one 4 room house, one 3 room house, one duplex with 4 room apartments and one duplex with 3 room apartments. In addition to lights, a number of radios, flat irons, waffle irons and toasters are used in the homes.

Farm Buildings: Improvements in addition to residences consist of meat packing plant, milk house, dairy barn, granary, hay barn, horse barn, poultry house, cattle feed barn, two hog houses, calf shed, machine shed and silo. All of the buildings are wired for lights and equipment. The milk house and packing plant are supplied with running water and natural gas in addition to lights.

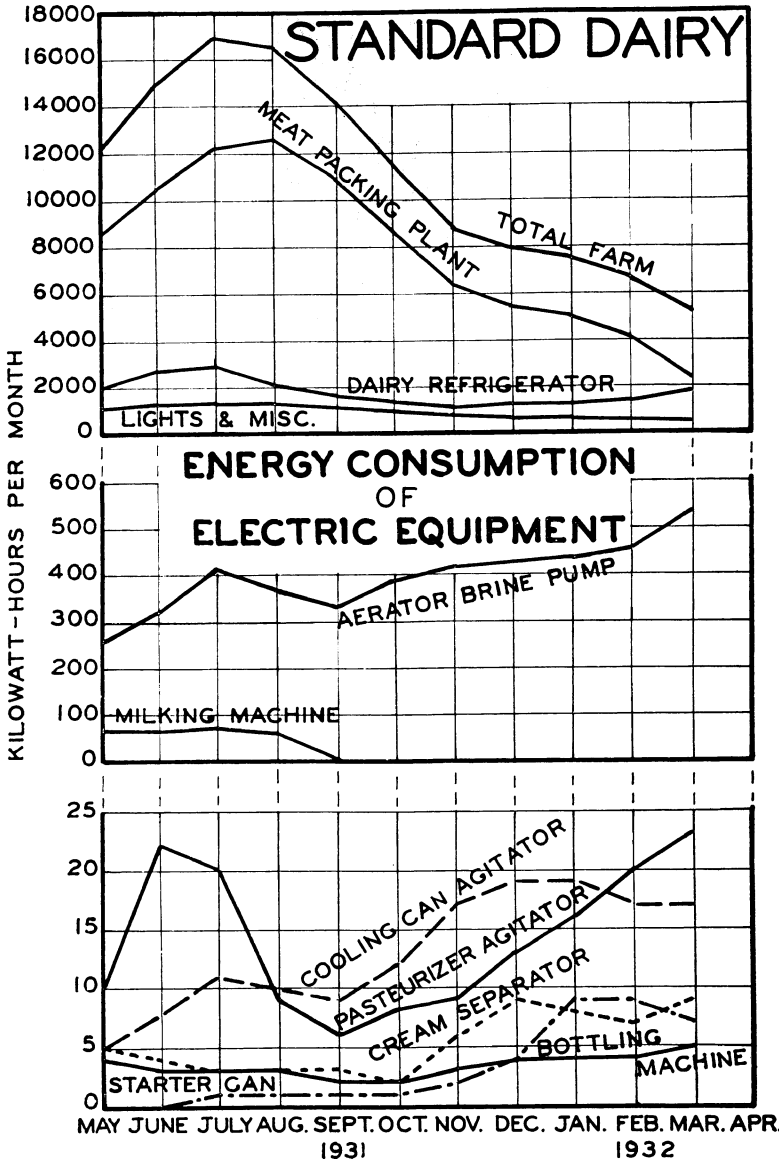
Farm Equipment: Electric equipment on the farm consists of dairy refrigerator, brine circulating pump, milking machine, cooling can agitator, pasteurizer agitator, starter can agitator, bottling machine, cream separator, churn, 25 horsepower feed grinder motor, water system and 105 horsepower of motor equipment in the packing plant. The water system consists of a 5 horsepower motor and pump that pumps water from a large cistern into an elevated tank for supplying the farm with running water. Other power equipment on the farm consists of 2 tractors, and 6 trucks.

Livestock: An inventory of November 14, 1931, gave 149 head of cattle and 13 horses. Most of the livestock killed for the packing plant is not raised on the farm but is purchased.

Crops: The 1931 production was 30 acres of corn, 78 acres of oats, 30 acres of hegari, 100 acres of alfalfa, 120 acres of tame pasture and 100 acres of wild pasture. The remaining land is taken up by timber and farm lots. The crops grown were fed to stock on the farm. In addition to the feed grown, considerable grain and supplement were purchased for feed throughout the year.



Continuous cycle bottling and capping machine and 200 gallon steam spray pasteurizer in use at the Standard Dairy. The bottling and capping machine shown in the upper picture is driven by a ½ horsepower motor the operating cost of which was 0.4 cents per 1000 bottles of milk. The pasteurizer agitator is electrically driven at a cost of 0.67 cents per 1000 pounds of milk pasteurized.


STANDARD DAIRY
MEAT PACKING PLANT
TOTAL FARM
DAIRY REFRIGERATOR
LIGHTS & MISC.
ENERGY CONSUMPTION
OF
ELECTRIC EQUIPMENT
AERATOR BRINE PUMP
MILKING MACHINE
COOLING CAN AGITATOR
PASTEURIZER AGITATOR
CREAM SEPARATOR
BOTTLING MACHINE
STARTER CAN
KILOWATT-HOURS PER MONTH
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
600
500
400
300
200
100
0
25
20
15
10
5
0
MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR.
1931
1932

Standard Dairy*

Monthly Kilowatt-hour Consumption of Electric Equipment From April, 1931, to April, 1932.

Month	Total kw-hr.	Meat packing plant	Dairy refrig-erator	Aerator brine pump	Cooling can agitator	Milking machine	Pasteur-izer agitator	Starter can agitator	Bottling machine	Cream separator	Lights and misc.
May	12,227	8,636	2,057	261	5	70	10		4	5	1,179
June	14,926	10,510	2,690	324	8	69	22		3	4	1,296
July	16,967	12,206	2,882	412	11	72	20	1	3	3	1,357
August	16,492	12,579	2,126	368	10	63	9	1	3	3	1,330
September	14,139	10,933	1,654	332	9		6	1	2	3	1,199
October	11,427	8,628	1,384	389	12		8	1	2	2	1,001
November	8,784	6,337	1,164	416	17		9	2	3	6	830
December	7,892	5,386	1,318	423	19		13	4	4	9	716
January	7,508	5,004	1,331	438	19		16	9	4	8	679
February	6,668	4,189	1,378	457	17		20	9	4	7	587
March	5,257	2,312	1,835	530	17		23	7	5	9	519
TOTAL	122,287	86,720	19,819	14,350	144	274	156	35	37	59	10,693
Average	11,117	7,884	1,802	395	13.1	68.5	14.2	3.9	3.4	5.4	972

* The meters were burned out by lightning during the last month of the test, consequently only 11 months' data was obtained and the final meter calibration was not made.

Standard Dairy*

Monthly Energy Consumption Cost of Electric Equipment From April, 1931, to April, 1932.

Month	Total cost	Average cost per kw.-hr.	Meat packing plant	Dairy refrig-erator	Aerator brine pump	Cooling can agitator	Milking machine	Pasteur-izer agitator	Starter can agitator	Bottling machine	Cream separator	Lights and misc.
May	$234.06	1.91¢	$165.32	$39.37	$4.99	$0.10	$1.34	$0.19	$0.00	$0.08	$0.10	$22.57
June	264.42	1.77	186.19	47.66	5.74	0.14	1.22	0.39	0.00	0.05	0.07	22.96
July	287.38	1.69	206.74	48.81	6.98	0.19	1.22	0.34	0.02	0.05	0.05	22.98
August	282.04	1.71	215.12	36.36	6.29	0.17	1.08	0.15	0.02	0.05	0.05	22.75
September	255.57	1.81	197.62	29.90	6.00	0.16		0.11	0.02	0.04	0.05	21.67
October	225.06	1.97	169.93	27.26	7.66	0.24		0.16	0.02	0.04	0.04	19.71
November	192.59	2.19	138.94	25.52	9.12	0.37		0.20	0.04	0.07	0.13	18.20
December	180.54	2.29	123.21	30.15	9.68	0.43		0.30	0.09	0.09	0.21	16.38
January	175.36	2.34	116.88	31.09	10.23	0.44		0.37	0.09	0.21	0.19	15.86
February	164.02	2.46	103.04	33.90	11.24	0.42		0.49	0.22	0.10	0.17	14.44
March	144.97	2.76	63.76	50.60	14.62	0.47		0.63	0.19	0.14	0.25	14.31
TOTAL	$2406.01		$1,686.75	$400.62	$92.55	$3.13	$4.86	$3.33	$0.83	$0.80	$1.31	$211.83
Average	218.73	1.97¢	153.34	36.42	8.41	0.28	1.22	0.30	0.09	0.07	0.12	19.26

* The meters were burned out by lightning during the last month of test, consequently only eleven months' data was obtained and the final meter calibration was not made.

Connected load in kilowatts: lights 6.36, equipment 157.5, total 163.86.

The meat packing plant has a capacity for the killing and curing of about 150 hogs and 50 cattle per week and a connected load of 106.5 kilowatts consisting largely of motors. The bulk of the energy required is used by the cold storage system.

The milking machine is a 4-unit of the pipe line type equipped with magnetic pulsator and driven by a 1 horsepower motor. It was used for 4 months to milk an average of 60 cows. The average energy consumption per cow per month was 1.14 kilowatt-hours costing 2.03 cents. The consumption per 1000 pounds of milk was 1.56 kilowatt-hours costing 2.81 cents.

The starter can was used in making butter milk and for warming milk that was to be separated. When the can was in use the agitator was run about 2 hours per day during the heating of about 570 pounds of milk. The can has a capacity of 100 gallons. The agitator is driven by a ¼ horsepower motor.

"Lights and misc." include the lights of 5 houses, milk house, dairy barn, granary, hay barn, horse barn, poultry house, cattle feed barn, two hog houses, machine shed and calf shed and the consumption of electric churn, water system, feed grinder and miscellaneous house appliances.

Standard Dairy

Bottling and Capping Machine Record From April, 1931, to April, 1932.

Month	Kw-hr.	Cost	NUMBER OF BOTTLES			Kw-hr. per 1000 bottles	Cost per 1000 bottles
			Quarts	½, ⅓, ¼ Quarts	Total		
May	4	$0.08	15,500	6,200	21,700	0.18	0.37¢
June	3	0.05	18,300	5,500	23,800	0.13	0.21
July	3	0.05	21,000	3,200	24,200	0.12	0.21
August	3	0.05	12,900	2,500	15,400	0.19	0.32
September	2	0.04	7,400	2,500	9,900	0.20	0.40
October	2	0.04	6,400	2,400	8,800	0.23	0.45
November	3	0.07	7,600	1,900	9,500	0.32	0.74
December	4	0.09	9,400	6,800	16,200	0.25	0.56
January	4	0.09	11,000	8,500	19,500	0.21	0.46
February	4	0.10	14,400	7,300	21,700	0.18	0.46
March	5	0.14	20,300	7,900	28,200	0.18	0.50
TOTAL	37	$0.80	144,200	54,700	198,900		
Average	3.4	0.07	13,109	4,973	18,082	0.19	0.40¢

Average kilowatt-hours required per 1000 pounds of milk bottled, 0.10.

Average cost per 1000 pounds of milk bottled, 0.23 cents.

An average of about 45 minutes per day was required for the bottling and capping of about 592 bottles of milk. The quarts were bottled with the machine running in low gear, at a rate of about two-thirds of the ½, ⅓, and ¼ quarts, which were bottled with the machine running in high gear.

The machine used was a 150-gallon per hour capacity, continuous cycle combined bottler and capper driven by a ½ horsepower motor.

Cream Separator Record From April, 1931, to April, 1932.

Month	Kw-hr.	Cost	Pounds milk separated	Kw-hr. per 1000 lbs. milk	Cost per 1000 lbs. milk
May	5	$0.10	16,300	0.31	0.61¢
June	4	0.07	10,200	0.39	0.69
July	3	0.05	7,900	0.38	0.63
August	3	0.05	7,000	0.43	0.71
September	3	0.05	6,500	0.46	0.77
October	2	0.04	4,000	0.50	1.00
November	6	0.13	12,900	0.46	1.01
December	9	0.21	21,300	0.42	0.99
January	8	0.19	21,300	0.38	0.89
February	7	0.17	19,100	0.37	0.89
March	9	0.25	23,700	0.38	1.05
TOTAL	59	$1.31	150,200		
Average	5.4	0.12	13,655	0.39	0.87¢

The separator is run on an average of 1 hour and 20 minutes per day for the separating of 447 pounds of milk. It has a capacity of 500 pounds per hour and is driven by a ⅛ horsepower motor.

Standard Dairy

Pasteurizer Agitator Record From April, 1931, to April, 1932.

Month	Kw-hr.	Cost	Pounds of milk pasteurized	Kw-hr. per 1000 pounds pasteurized	Cost per 1000 pounds pasteurized
May	10	$0.19	40,000	0.25	0.48¢
June	22	0.39	46,300	0.48	0.84
July	20	0.34	44,600	0.45	0.76
August	9	0.15	38,200	0.24	0.39
September	6	0.11	25,900	0.23	0.42
October	8	0.16	31,500	0.23	0.51
November	9	0.20	38,800	0.25	0.52
December	13	0.30	53,400	0.24	0.56
January	16	0.37	53,800	0.30	0.69
February	20	0.49	49,900	0.40	0.98
March	23	0.63	71,600	0.32	0.88
TOTAL	156	$3.33	494,000		
Average	14.2	0.30	44,909	0.32	0.67¢

The agitator was operated on an average of two hours per day during the pasteurizing of around 1470 pounds of milk.

A 200-gallon capacity, steam spray type pasteurizer was used, the agitator of which was driven by a ½ horsepower motor.

Dairy Refrigerator Record From April, 1931, to April, 1932.

Month	Total kw-hr.*	Total cost*	Total lbs. milk cooled†	Kw-hr. per 100 lbs. cooled	Cost per 100 lbs. cooled
May	2,323	$44.46	66,700	3.48	6.67¢
June	3,022	53.54	76,600	3.95	6.99
July	3,305	55.98	81,900	4.04	6.84
August	2,504	42.82	76,400	3.28	5.60
September	1,995	36.06	63,200	3.16	5.71
October	1,785	35.16	80,800	2.21	4.35
November	1,597	35.01	101,200	1.58	3.46
December	1,760	40.26	106,800	1.65	3.77
January	1,788	41.76	107,600	1.66	3.88
February	1,852	45.56	110,500	1.68	4.12
March	2,382	65.69	153,800	1.55	4.27
TOTAL	24,313	$496.30	1,025,500		
Average	2,210	45.12	93,227	2.37	4.83¢

* Brine circulating pump and cooling can agitator included.

† The actual amount of milk handled is only about one-half of that cooled since most of it is cooled before pasteurizing and again after pasteurizing.

Average temperature of cooled milk, 37°F.

Average temperature of the box, 37°F.

Average pounds of milk cooled per day, 3,052.

Average pounds of milk stored in box continuously, 655.

Average time required for cooling per day, 5 hours and 40 minutes.

Most of the milk is cooled twice; once by brine circulated around a cooling can, and again by brine circulated through an aerator. As the milk is drawn from the cows it is cooled in the cooling can, and held over until pasteurized. After being pasteurized it is cooled over the aerator.

The cooling can has a capacity of 150 gallons and is equipped with an agitator driven by a ¼ horsepower motor. The consumption of the agitator per 1000 pounds of milk cooled was 0.28 kilowatt-hours costing 0.61 cents.

The aerator has a capacity of 150 gallons per hour. The 470 gallons of brine used in cooling is stored in an insulated box outside the cold room and held at a temperature of 8°F. It is circulated through the aerator and cooling can by a rotary pump driven by a 2 horsepower motor. The consumption of this pump per 1000 pounds of milk cooled was 4.24 kilowatt-hours, costing 9.02 cents.

The refrigerator box or cold room is 11x14x10 feet in size, has two doors and is cooled by direct expansion.

The refrigerator compressor is a 5-ton, water-cooled, ammonia unit, driven by a 10 horsepower motor.

T. M. TOWNSEND

General Facts: Mr. T. M. Townsend's address is R.F.D. No. 9, Oklahoma City, Oklahoma. The farm is located 3½ miles east of Broadway on Reno Street Road, out of Oklahoma City. It is a general farm of 40 acres owned, managed and operated by Mr. Townsend and family. The family at home consists of 4 people, Mr. and Mrs. Townsend and daughter and Mrs. Townsend's mother. The farm income was derived from the sale of poultry, butter, eggs and a few head of cattle. The farm is served electricity from a 2200 volt primary line through a 3 kva. transformer. A 110-220 volt, 3-wire service is run from the transformer to a 100 ampere entrance switch. The connected load is 14.63 kw. of which 0.95 is lights and 13.68 is equipment. The buildings are adequately wired for lights and power. The wiring and fixtures were installed at a cost of around $275.

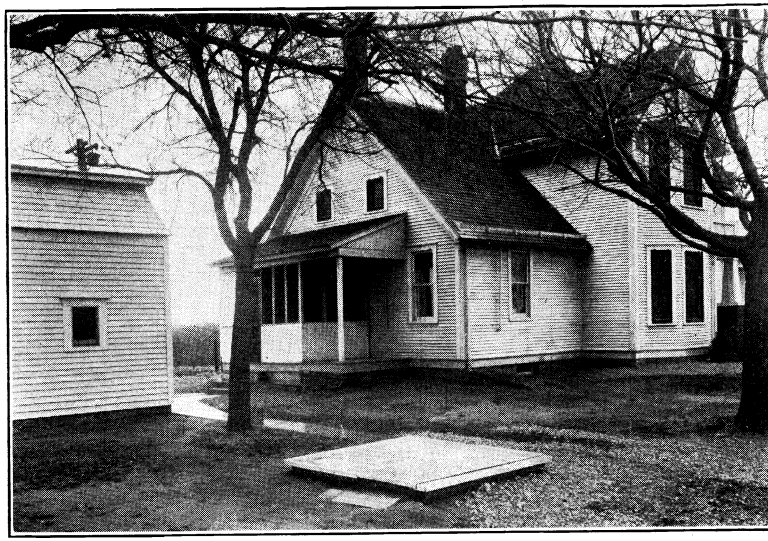
The Home: The house is a two-story wooden structure with eight rooms and bath, and is equipped with electric lights, running water, and sewage disposal system. A coal stove is used for heating during the winter months. Electric conveniences used in the home besides lights are electric range, refrigerator, vacuum cleaner, flat iron, waffle iron, reflector heater, heating pad, toaster, water heater, radio, portable fan and electric clock. The cost of this equipment when purchased was estimated to be $1325.

Farm Buildings: The improvements in addition to the house are general barn for horses and cows, feed house, two-car garage, poultry house, pump house and pit silo. All of the buildings are wired and equipped with electric lights.

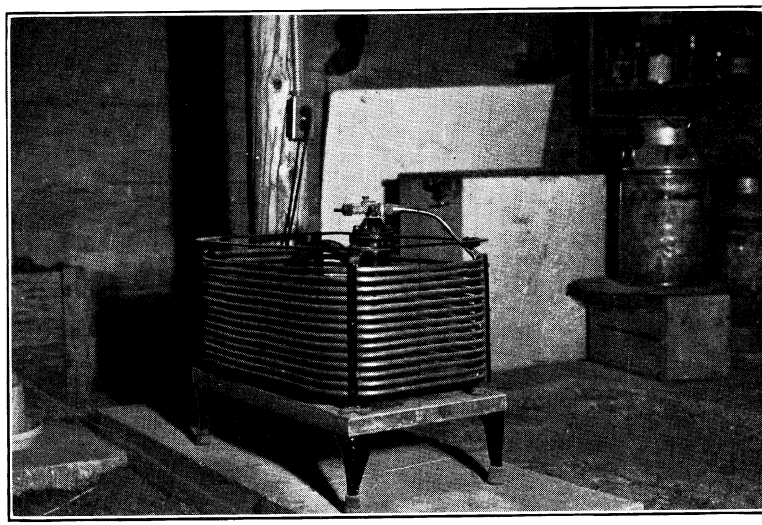
Farm Equipment: The water system is the only piece of electric farm equipment used. This system furnishes water under pressure to the house, poultry house and barnyard. A float valve is used at the stock tank to keep it full at all times. The pump is driven by a 1 horsepower motor and is located underground in a pit with the pressure tank located in the cellar of the house. The cost of the system, including pipe and well casing, was estimated to be $310.

Livestock and Poultry: An inventory of July 27, 1931, gave 2 cows, 3 horses and 80 chickens.

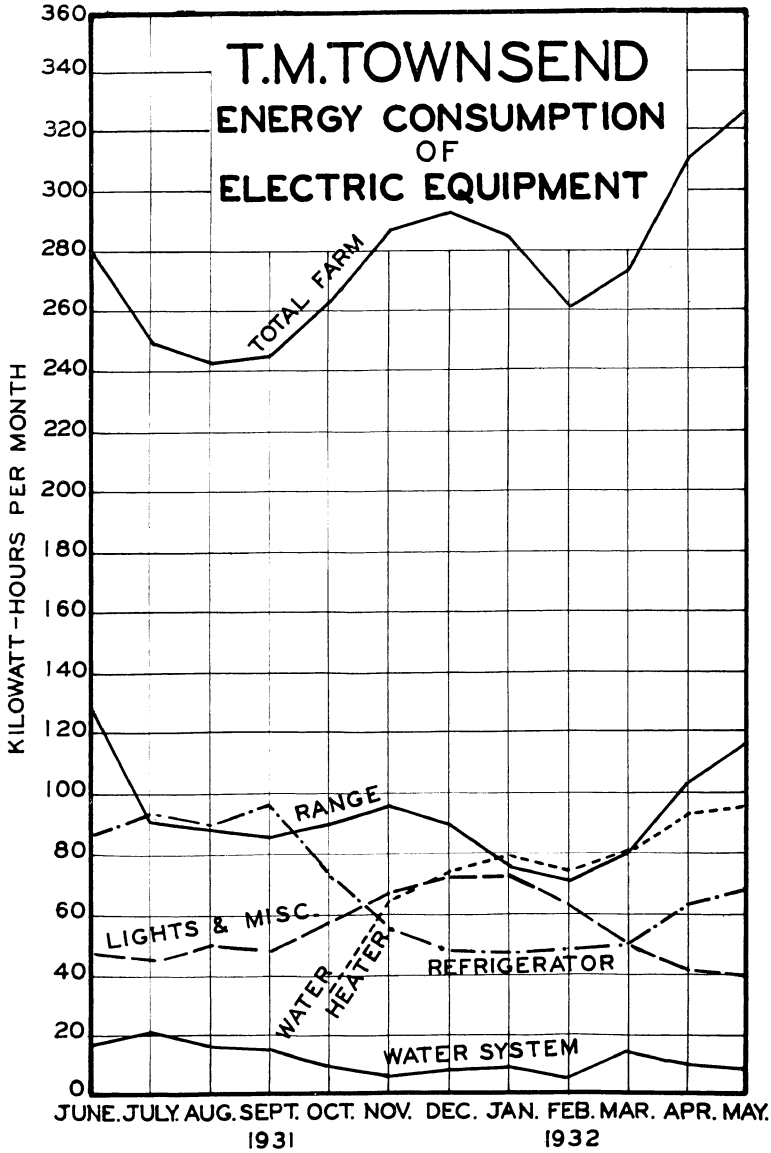
Crops: The 1931 production was 8 acres of corn, 7 acres of oats, 20 acres of wild pasture and a small amount of garden. Most of the feed grown was consumed by stock on the farm. Some additional feed was bought throughout the year for poultry and cows.



The T. M. Townsend residence in which an electric range, refrigerator, water heater, and numerous small appliances are used. In the foreground may be seen the covered pit in which the automatic water system is located.



The refrigerating unit of T. M. Townsend's refrigerator is located in the basement apart from the box.


T.M.TOWNSEND
ENERGY CONSUMPTION
OF
ELECTRIC EQUIPMENT
KILOWATT-HOURS PER MONTH
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
TOTAL FARM
RANGE
LIGHTS & MISC.
WATER HEATER
REFRIGERATOR
WATER SYSTEM
JUNE. JULY. AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY.
1931
1932

T. M. Townsend

Monthly Kilowatt-hour Consumption of Electric Equipment From May, 1931, to June, 1932.

Month	Total kw-hr.	Electric range	House refrig-erator	Water heater	Water system	Lights and misc.
June	279	128	87		17	47
July	250	91	93		21	45
August	243	88	89		16	50
September	245	86	96		15	48
October	263	90	73	34*	9	57
November	287	96	55	63	6	67
December	293	90	48	74	8	73
January	284	76	47	79	9	73
February	261	71	48	74	5	63
March	274	80	50	80	14	50
April	311	104	63	93	10	41
May	326	116	68	95	8	39
TOTAL	3316	1116	817	592	138	65.3
Average	276.3	93	68	78.9	11.5	54.4

Monthly Energy Consumption Cost of Electric Equipment From May, 1931, to June, 1932.

Month	Total bill	Average cost kw-hr.	Electric range	House refrig-erator	Water heater	Water system	Lights and misc.
June	$15.04	5.39¢	$6.90	$4.69		$0.92	$2.53
July	14.13	5.65	5.14	5.26		1.19	2.54
August	13.91	5.72	5.04	5.09		0.92	2.86
September	13.97	5.70	4.90	5.47		0.86	2.74
October	14.54	5.53	4.98	4.03	$1.88*	0.50	3.15
November	15.29	5.33	5.11	2.93	3.36	0.32	3.57
December	15.48	5.28	4.75	2.54	3.91	0.42	3.86
January	15.20	5.35	4.06	2.52	4.23	0.48	3.91
February	14.48	5.55	3.94	2.66	4.11	0.28	3.49
March	14.89	5.43	4.35	2.72	4.35	0.76	2.71
April	16.05	5.16	5.37	3.25	4.80	0.52	2.11
May	16.53	5.07	5.88	3.45	4.82	0.40	1.98
TOTAL	$179.51		$60.42	$44.61	$31.46	$7.57	$35.45
Average	14.96	5.41¢	5.04	3.72	4.19	0.63	2.95

* Two weeks operation.

Connected load in kilowatts: lights 0.95, equipment 13.68, total 14.63.

The water system furnishes water from a 102-foot well for an average of 4 people, 3 head of cattle, 3 horses, and 150 chickens, and in addition water for flowers and lawn.

Size of refrigerator, 9 cu. ft.

The water heater has a capacity of 10 gallons, a 3 kw. heating element, and automatic temperature control.

"Lights and misc." include the consumption of house lights, barn lights, poultry house lights, yard lights, radio, vacuum cleaner, iron, waffle iron, reflector heater, heating pad, fan, and clock.

T. M. Townsend

Electric Range Record From May, 1931, to June, 1932.

Month	Total kw-hr.	Total cost	Number people	Daily meals	Total meal units	Kw-hr. per 100 meal units	Cost per 100 meal units
June	128	$6.90	4	3	405	31.6	$1.70
July	91	5.14	2.3	3	221	41.2	2.33
August	88	5.04	3	2	200	44.0	2.52
September	86	4.90	3	2	180	47.8	2.72
October	90	4.98	3	2	196	45.9	2.53
November	96	5.11	3.3	3	304	31.6	1.68
December	90	4.75	4	3	372	24.2	1.27
January*	76	4.06	4	3	310	24.5	1.31
February*	71	3.94	4	3	353	20.1	1.12
March	80	4.35	4	3	372	21.5	1.17
April	104	5.37	4	3	402	25.9	1.34
May	116	5.88	4	3	372	31.2	1.58
TOTAL	1116	$60.42			3687		
Average	93	5.04	3.55		307	30.3	$1.64

* Part of the cooking was done on heating stove.

Size of range: 3 plate and oven, 6800 watts.

Average kilowatt-hours per person per month, 26.1.

Average cost per person per month, $1.42.

Average time used per day, 2½ hours.

W. N. WETZEL

General Facts: Mr. W. N. Wetzel's address is Bixby, Oklahoma. The farm is located 3 miles north of Bixby. It is a general farm of 360 acres of land owned by Mr. Wetzel, with 260 of the land rented to and farmed by tenant farmers. The remaining 100 acres are managed and operated by Mr. Wetzel and family. The family residing at home consists of Mr. and Mrs. Wetzel and son. One hired man is kept the year round and additional help hired when needed. The farm income is derived from the sale of hogs, hay, grain and pecans. Electricity is supplied the farm from a 2300 volt primary line through a 3 kva. transformer. A 110 volt 2-wire service is run from the transformer to a 30 ampere entrance switch. The connected load consists of 1.0 kw. in lights and 3.96 kw. in equipment, a total of 4.96 kw. The wiring and fixtures for the farm were installed at a cost of around $115.

The Home: The residence is a five-room wooden structure equipped with electric lights, running water, natural gas for cooking, and sewage disposal system. A coal furnace is used for heating during the winter months. Electric conveniences used in the home other than lights are refrigerator, radio, flat iron, waffle iron, hot plate, toaster, vacuum cleaner, croup kettle, portable fan, reflector heater, and heating pad. The cost of this equipment when purchased was estimated to be $570.

Tenant Houses: Four houses are located on the farm in addition to the home residence. Three of these are the homes of the tenant farmers and the hired man. Two of them are three-room wooden structures and one is a four-room wooden structure. These houses with a few improvements are located apart from the home improvements and are not supplied with electric service. The fourth house is the home of Mr. Wetzel's mother.

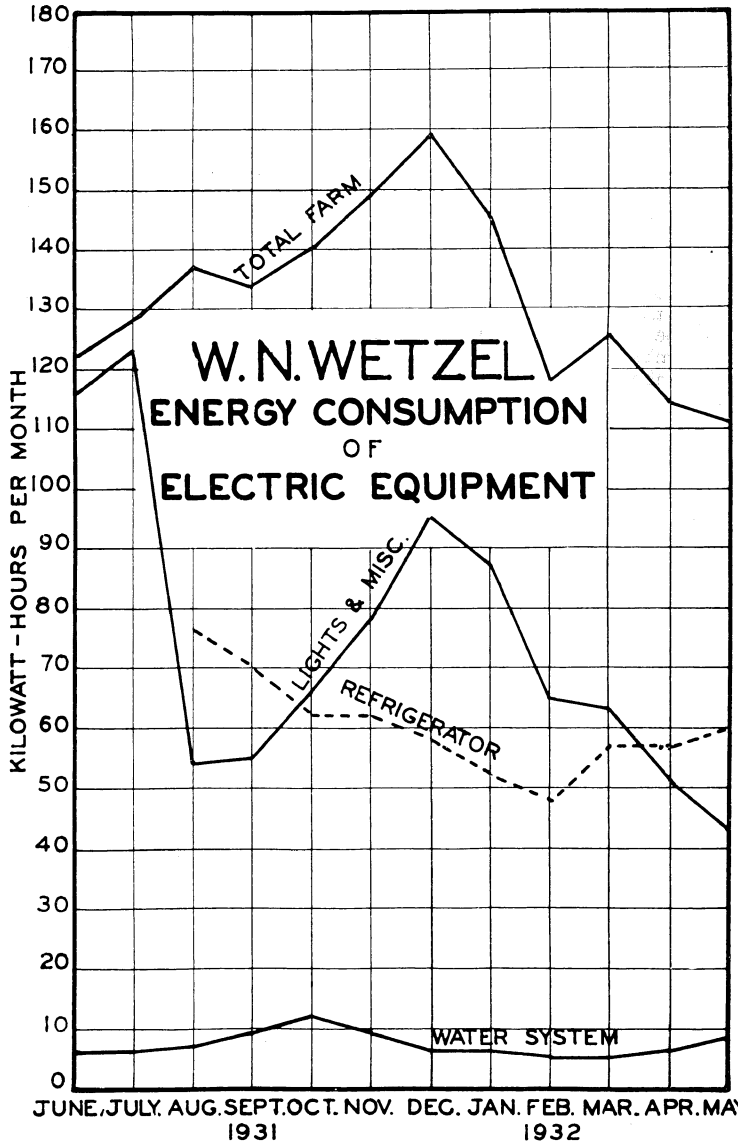
It is a seven-room wooden structure equipped with running water, lights and sewage disposal system. The lights are metered separately from the farm and are not included in the total consumption.

Farm Buildings: The home improvements other than house consist of general barn, hay barn, cow and hog shed, corn crib, garage and pump house, and two poultry houses. The garage and pump house is the only building wired for lights and equipment.

Farm Equipment: The pressure water system is the only electric equipment used outside the home. This furnishes running water to the house and to the barn lots. The cost when purchased was estimated to be $105. Other power equipment used on the farm is a two-plow tractor and a five horsepower gasoline engine for sawing wood and grinding feed.

Livestock and Poultry: An inventory of September 18, 1931, gave 9 head of cattle, 4 horses, 118 hogs, 13 goats, and 75 chickens.

Crops: The 1931 production for the farm, including the land rented out, was 100 acres of corn, 80 acres of oats, 24 acres of alfalfa, 10 acres of prairie hay, 26 acres of cowpea hay, 40 acres of tame pasture and a 60 acre grove of pecans. Most of the feed grown was fed to stock on the farm, the remainder and the pecans were sold as a cash crop.


W. N. WETZEL
ENERGY CONSUMPTION
OF
ELECTRIC EQUIPMENT
TOTAL FARM
LIGHTS & MISC.
REFRIGERATOR
WATER SYSTEM
KILOWATT-HOURS PER MONTH
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
JUNE. JULY. AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY
1931
1932

W. N. Wetzel

Monthly Kilowatt-hour Consumption of Electric Equipment From May, 1931, to June, 1932.

Month	Total kw-hr.	House refrigerator	Water system	Lights and misc.
June	122		6	116*
July	129		6	123*
August	137	76	7	54
September	134	70	9	55
October	140	62	12	66
November	149	62	9	78
December	159	58	6	95
January	145	52	6	87
February	118	48	5	65
March	125	57	5	63
April	114	57	6	51
May	111	60	8	43
TOTAL	1583	602	85	896
Average	132	60.2	7	74.7

Monthly Energy Consumption Cost of Electric Equipment From May, 1931, to June, 1932.

Month	Total bill	Average Cost per kw-hr.	House refrigerator	Water system	Lights and misc.
June	$8.66	7.10¢		$0.43	$8.23*
July	8.87	6.88		0.41	8.46*
August	9.11	6.65	$5.05	0.47	3.59
September	9.02	6.73	4.71	0.61	3.70
October	9.20	6.57	4.07	0.79	4.34
November	9.47	6.36	3.94	0.57	4.96
December	9.77	6.14	3.56	0.37	5.84
January	9.35	6.45	3.35	0.39	5.61
February	8.54	7.24	3.47	0.36	4.71
March	8.75	7.00	3.99	0.35	4.41
April	8.42	7.39	4.21	0.44	3.77
May	8.33	7.50	4.50	0.60	3.23
TOTAL	$107.49		$40.85	$5.79	$60.85
Average	8.96	6.79¢	4.09	0.48	5.07

* House refrigerator included.

Connected load in kilowatts: lights 1.0, equipment 3.96, total 4.96.

The water system furnishes water from a shallow well for an average of 4 people, 3 horses, 6 head of cattle, 40 hogs, and 100 chickens and in addition drinking water for 7 families that haul from the well.

The refrigerator has a capacity of 6 cu. ft.

"Lights and miscellaneous" include house lights, garage and pump house lights, yard lights, radio, flat iron, waffle iron, hot plate, toaster, vacuum cleaner, croup kettle, portable fan, reflector heater, and heating pad.

SUMMARY OF ELECTRIFIED FARM EQUIPMENT

LIGHTING FOR THE FARM

Lighting is the most popular use of electricity on the farm. The desire for electric lights has often caused rural people to make considerable investment in electric lines that cannot be justified economically where lights alone are used. Lights are commonly looked upon as a convenience and a luxury. Their true value, however, is the improvement of family health, the greater attractiveness of farm life and the increased efficiency of farm labor.

In the farm home electric lights banish the chore of cleaning and filling kerosene lamps, a task that requires about two days of time throughout the year. Added to this is the time saved due to more efficient labor as the result of better light. The better light relieves the strain on eyes and prevents nearsightedness, a condition quite common among farm children. A survey by the New York Health Department in that state found that 21 per cent of the country children had defective vision while only 5 per cent of the city children were so afflicted.

TABLE 1.—Residences Metered on Cooperating Farms

Co-operator	Average kw-hr. per mo.	Rooms in house	Conveniences included in addition to house lights
Glen McWilliams	20	5	Radio, flat iron
J. A. Purviance	53	11	Poultry house, garage, waffle iron, vacuum cleaner, corn popper, hot plate, reflector heater, flat iron, toaster
Peter J. Schmaltz	16	6	Wash house, yard lights, flat iron, toaster, waffle iron, percolator
B. L. Odom	41	6	Radio, flat iron
Joe Frey	22	9	Wash house, garage, yard lights, radio
Howard W. Phillips	58	10	Vacuum cleaner, radio, toaster, flat iron, waffle iron
Average	35	7.8	

Energy consumption for lighting differs little between rural and urban homes. Table 1 gives the consumption of six farm residences of different sizes. The kilowatt-hours used in each residence represent the consumption of the lights and the small appliances listed. The average monthly consumption for an eight-room house over a year was 35 kilowatt-hours. This consumption represents a cost of $2.36 at the existing rates on the co-operating farms. The consumption varies over the different seasons of the year, as may be seen from the curves of each farm; the highest consumption occurs during the short winter days of December and January and the lowest consumption during the summer.

In the barn the electric light is a valuable saver of time and property. Where the barn is well lighted the chores may be done in two-thirds the time required where a smoked-up kerosene lantern is held in one hand and the work is done with the other. The fire hazard of the lantern being

kicked over by a cow, exploding, or otherwise setting the barn on fire is eliminated by the use of electric lights.

TABLE 2.—Barns Metered on Cooperating Farms

Cooperator	Average kw-hr. per mo.	Type of barn	Equipment included in addition to lights
Howard W. Phillips	2.3	General	Yard light
T. T. Baker	60.0	Dairy	Feed house, cattle shed, 2 yard lights
E. K. Gaylord	126.0	Dairy	4 ventilating fans, electrocutor screens

The energy consumption of the barn depends upon the type of use and the habits of the farmer. Table 2 gives the energy consumption of three barns. The barn of Mr. Phillips is used for feed storage, work horses and a few cows. The chores done in the barn after dark require little time, consequently the energy consumption is probably somewhat lower than that for the average barn. The barn of Mr. Gaylord is a large dairy barn, the electric consumption of which is due more to the 4 ventilating fans than to the lights. The consumption of Mr. Baker's dairy barn is also above that used for lights in the average dairy barn because two yard lights supplied from the barn circuit are left burning throughout the night on dark nights.

The use of electric lights in the poultry house for the stimulation of egg production during the short winter months has proven valuable to the poultry man. The lights increase the total daily feed consumption by increasing the hours of feeding. By increasing the feed consumption the winter molting period may be controlled and the period of peak egg production may be shifted from a season of low prices to a more favorable price season. The total yearly egg production may not be materially increased. The common practice is to turn the lights on in the early morning hours at such a time as will give a total daily feeding period of from 12 to 14 hours.

The energy consumption of poultry house lighting was kept for a few months on two cooperating farms. The lights were turned on by time clocks between 4 and 5 o'clock in the morning and left burning until daybreak during the months from November to March, inclusively. The monthly kilowatt-hours consumption for the time metered averaged 14 kilowatt-hours for Mr. MacArthur's poultry house and 18 kilowatt-hours for Mr. Smith's poultry house. The average for the two houses was 16 kilowatt-hours per month, costing $1.57 for 170 hens.

No attempt was made on the cooperating farm to determine the effect of lights on the egg production since facilities were not available for such a study. One of the cooperators, however, indicated that there was a quite noticeable decline in his egg production during a two weeks period in which the time clock was out of order and lights were not used.

The lighting of garage, granaries, machine shed and other miscellaneous buildings about the farm adds much to the attractiveness of farm life and helps decrease the time required for doing farm chores. The electricity required for lighting these buildings is very little and as an item of cost in the electric bill may be neglected.

THE FARM WATER SYSTEM

The automatic water system is probably the most valuable contribution of electricity to the farm home. It is one of the first conveniences installed after electric service is secured. Running water under pressure may be supplied the farm home at a cost no greater than a similar service in the

city. With running water, the sanitary condition of the home may be materially improved. The modern bath room and kitchen sink with septic tank for sewage disposal, are available at reasonable cost. The electric system eliminates the hard labor of pumping and carrying water, so that, as a result, a plentiful supply of water is available for the home and stock at all times.

Each of the 22 farms on which records were kept was supplied with running water. Fourteen of these farms used electricity as the only source of power for pumping water. Three others used electricity as a source of power for the house supply. One farm used electricity as a stand-by source of power and four used other sources of power.

TABLE 3.—Specifications of Water Systems on Cooperating Farms

Cooperator	Type system	Well depth in feet	Average pounds pressure	Motor hp.	Capacity gals. per hour	Size tank gallons
Peter J. Schmaltz	B	12	25	¼	250	6
Joe Frey	B	3	25	¼	210	5
Howard Phillips	B	15	30	¼	250	20
W. N. Wetzel	B	20	30	⅓	250	35
D. C. Hybarger	B	0	25	¼	210	5
I. F. Melrose	B	50	24	¼	250	6
J. W. Henderson	B	4*	60	½	400	80
T. M. Townsend	C	102	28	1	420	180
Howard Phillips	A	18	30†	¼		1200
D. D. Banta	C	50	25	½	330	40
Charles H. Rodieck	C	207	30	½	275	300
C. R. Birks	A	40	10†	½	300	80
Roy Kneeland	A	65	14†	½	230	4000
J. A. Purviance	C	168	30	1	400	35
T. T. Baker	C	150	40	1	200	100
E. K. Gaylord	C	435	30	5	3300	750
Average		83.2	26	0.77	485	427

* The water level is above the pump.

† Pressure is given in feet of water head.

(A) Manually controlled gravity system using stock pump and pump jack.

(B) Automatic shallow well pressure system.

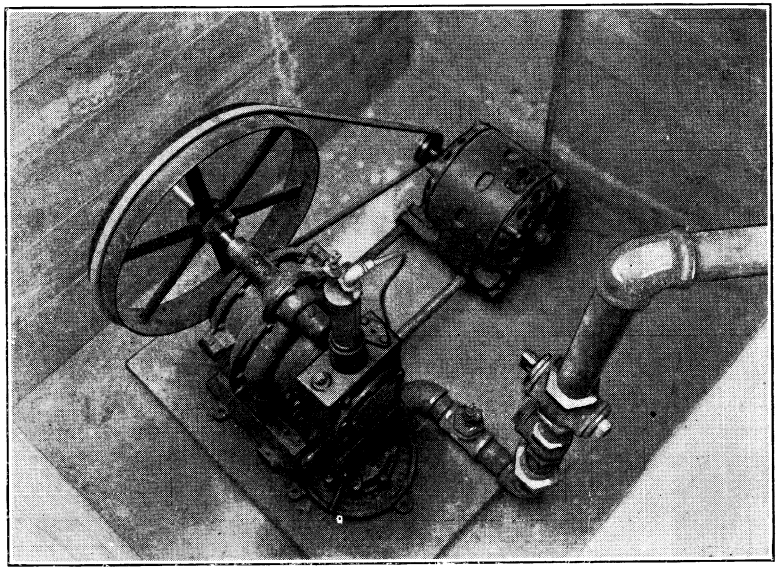
(C) Automatic deep well system.

Table 3 gives the specifications of the water systems metered on cooperating farms. The first seven systems listed use shallow well pumps with pump head and cylinder combined. Their maximum suction lift is about 22 feet. They may be used on wells deeper than 22 feet if set down in the well to within 22 feet of the water as was done at Mr. Melrose's farm. The

remaining nine systems listed in the table use deep well pumps with the cylinder located near the bottom of the well. The capacities of the water systems vary from 200 gallons per hour to 3300 gallons per hour. For house use the 200 to 250 gallon per hour system is the one generally used. Where water is supplied to the entire farm, the required system capacity will depend upon the amount of water needed. For most farms a capacity of 200 to 450 gallons per hour is generally sufficient.

In Table 4 is given the average monthly kilowatt-hours used by the water systems metered and the people, stock, and other uses, for which water is supplied. The first three systems listed supply water for house use only. The consumption of these average 1.1 kilowatt-hours per month, which at existing rates on the farms, cost 10 cents. At Mr. Kneeland's, an electric motor is used with a pump jack as a stand-by source of power for the windmill. The study of the monthly energy consumption curve of this system is of interest in that it shows the unreliability of wind for pumping water during the summer months when the greatest amount of water is needed.

The average energy consumption of all water systems metered was 53 kilowatt-hours per month where the average well depth was 83 feet and water was supplied to an average of 7 people, 5 horses, 34 head of cattle, 14 hogs, 3 sheep and 588 chickens. This represents a monthly cost for water of $2.69 when taken as an average for all water systems metered.



The automatic deep well pump at T. M. Townsend's is located below the frost line in a concrete lined pit and has the pressure tank in the basement of the house.

TABLE 4.—Water Systems Metered on Cooperating Farms

Cooperator	Average kw-hr. per mo.	Well depth	Number people	AVERAGE NUMBER STOCK WATERED					Other uses of water
				Cattle	Horses	Hogs	Sheep	Poultry	
Peter J. Schmaltz	1	12	4					300	
Joe Frey	1	3	8						
Howard Phillips	1.4	15	4						
W. N. Wetzel	7	20	4	6	3	40		100	7 families drinking water
D. C. Hybarger	13	0	5	3				1650	
I. F. Melrose	45	50	8	20	10	20		190	
J. W. Henderson	72	4*	7	116	3	6		65	Washing out dairy barn and milk house, cooling refrigerator
T. M. Townsend	12	102	4	3	3			150	Watering flowers and lawn
Howard Phillips	14	18		14	10	12		110	
D. D. Banta	15	50	6	6	5	15		210	Watering flowers
C. H. Rodieck	22	207	10		2			5600	Washing incubator trays, gasoline filling station
C. R. Birks	35	40	9	44	6			120	Washing out dairy barn and milk house
Roy Kneeland†	35	65	10	60	7			315	Cooling milk
J. A. Purviance	83	168	5	63	12			190	Washing out dairy barn, watering flowers
T. T. Baker	124	150	17	120	5	36		115	Washing out dairy barn, and milk house, cooling refrigerator
E. K. Gaylord	360	435	17	93	7	96	40	300	Washing out dairy barn, and milk house, cooling refrigerator, garden irrigation
Average	52.5	83.2	7.4	34.3	4.6	14	2.5	588	

* Water level is above the pump.
† The electric pump is used as a stand-by for the windmill.

ELECTRIC RANGES

The electric range is gaining favor on the farm as a source of heat for cooking. The intense heat in the farm kitchen produced by coal and wood stoves during the summer months is being eliminated by the kerosene, gasoline, and electric ranges. The electric range has the advantage over the other ranges in that it is more convenient, cleaner, requires less time and attention, and is safer to operate. These advantages are being recognized by the farm home makers in their demands for the improvement of conditions in the farm kitchen.

TABLE 5.—Electric Ranges on Cooperating Farms

Co-operator	Number in family	Average kw-hr. per mo.	Kw-hr. per 100 meal units	Kw-hr. per mo. per person	Size range
T. M. Townsend	3-4	93	30.3	26.1	6.8 kw., 3 plate and oven
Peter J. Schmaltz	4	154	43	38.5	6.7 kw., 3 plate and oven
D. D. Banta	6	183	51	30.5	7.0 kw., 3 plate and oven
Joe Frey*	8	16.4			5.7 kw., 2 plate and oven
Average	4.5	143	41.4	31.7	

* The range was used only for baking and a few meals per month, consequently it was not included in computing averages.

The apparent high cost of operation seems to be the main stumbling block to the use of the electric range. In order to determine the cost of operation, records were kept on four electric ranges for a year. The four cooperating farmers are listed in Table 5 and the unit and average consumption of these ranges given. The ranges of Mr. Townsend and Mr. Banta were used as the only source of heat for cooking. During part of the year only two meals per day were prepared on the ranges, the third meal being a light lunch for which the ranges were seldom used. The range of Mr. Schmaltz was used in connection with a coal stove. The electric range was used for about six months during the hot weather when fire was not needed for heat in the kitchen. During the remainder of the year the coal range was used to heat the kitchen and a source of heat for cooking. A large amount of canning was done during the spring and summer months by Mrs. Townsend and by Mrs. Schmaltz. It is the opinion of both home makers that the electric range cannot be excelled as a source of heat for canning.

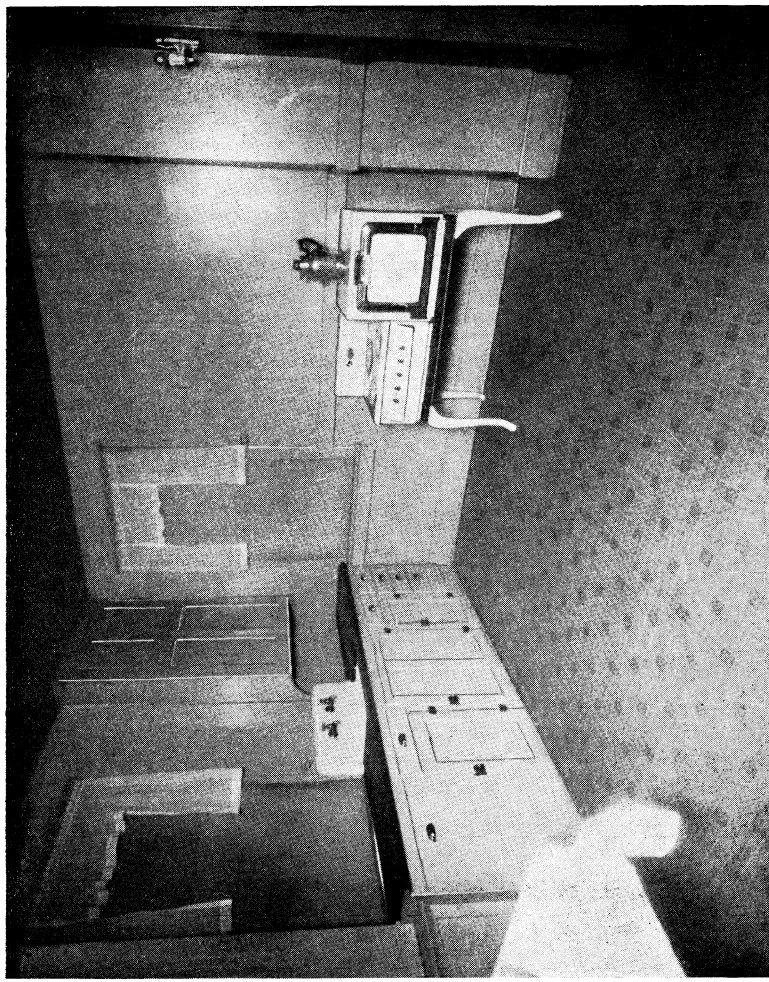
The range of Mr. Frey was a combination coal and electric. The electric part of this range was used for the family baking, and for the preparation of quick meals. It was not used more because the cost of operation was thought to be too high. Since the electric part of this range was not used regularly it was not included in the average of Table 5.

Considering the three ranges regularly used, the average shown in Table 5, gives a consumption for 4.5 people of 143 kilowatt-hours per month, or a unit consumption of 31.7 kilowatt-hours per month per person. At the average existing rates on the farms the cost was $6.50 per month, or $1.74 per month per person. The addition to an existing power bill where the energy charge is 3 cents per kilowatt-hour, however would be only $4.29 per month, or $0.95 per month per person. The average energy consumption per 100 meals for one person was 41.4 kilowatt-hours the cost of which was $2.23. At 3¢ a kilowatt-hour this would cost $1.24.

The average energy consumption of ranges reported from all states as given by the National C. R. E. A. in Electricity on the Farm, Volume VII, No. 1, was 28.4 kilowatt-hours per month per person. The value of 31.7 ob-

tained on Oklahoma farms is slightly above the average. This can be accounted for in part by the smaller number of people cooked for, the national average being 5.8 people and that for Oklahoma 4.5. Generally speaking the greater the number of people cooked for the less will be the cost per person.

The following picture is the T. M. Townsend kitchen showing the electric range that is used as the only source of heat for cooking at a cost of $1.42 per person per month.

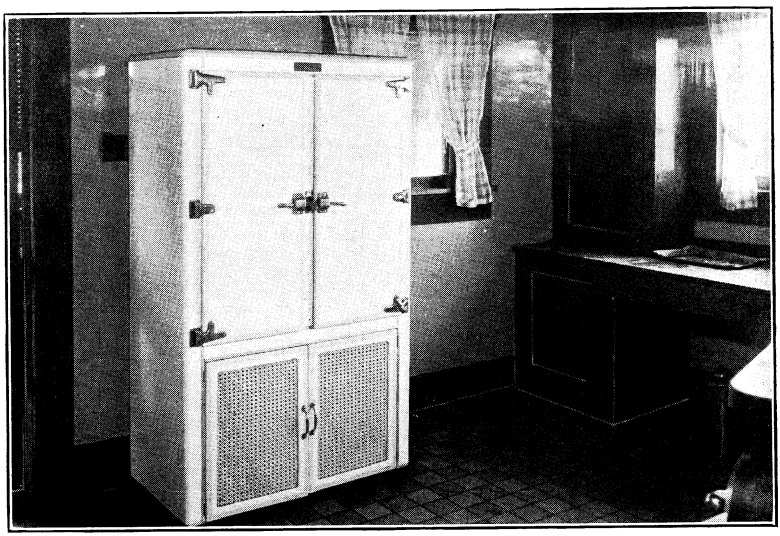


DOMESTIC REFRIGERATORS

The refrigerator for the farm home is no longer a luxury. The food and produce allowed to spoil for lack of refrigeration in the farm home will pay the cost of refrigeration. Surplus dairy products, eggs, fruit, vegetables, and meat may be kept in the refrigerator until they can be taken into town and sold. Perishable foods purchased in town may be held over until they are needed. The farm cellar, well, and milk house are inconvenient and are not satisfactory as a source of refrigeration because such perishables as dairy products, eggs, fruit, vegetables and meat require temperatures lower than can be obtained by these means. The ice box is satisfactory for refrigeration where perishables can be disposed of in a relatively short time and low temperatures are not desired, but it requires considerable time and expense for going after ice, in addition to the cost of the ice.

The electric refrigerator is an ideal source of refrigeration for the farm. The automatic control maintains a constant low temperatutre at all times. The temperature held may be changed to give the degree of refrigeration desired for different classes of products. Refrigeration is available for frozen desserts and for the freezing of ice cubes used in the cooling of drinking water.

There is a tendency to select undersized refrigerators because of the high first cost. A capacity less than the seven or nine cubic feet size is not advisable on the farm where produce is kept in the box. The trend of demand is for a larger refrigerator on the farm than in the city, since more food and produce must be kept in it. To supply the demand at reasonable cost the large built-in type refrigerator is being developed in a number of states. In selecting the size of a refrigerator, the operating cost should be a minor factor since the energy consumption does not vary directly as the volume of the box.



The refrigerator box used in the Joe Frey home, the refrigerating unit of which is located in the cellar.

TABLE 6.—Domestic Refrigerators on Cooperating Farms

Cooperator	Size family	Size box cu. ft.	KILOWATT-HOUR PER MONTH		
			Average	Minimum	Maximum
D. D. Banta	6	5½	47	18	77
W. N. Wetzel	3	6	60	48	76
R. F. MacArthur	2	6	62	39	87
Peter J. Schmaltz	4	7	34	15	61
T. M. Townsend	4	9	68	47	96
D. C. Hybarger	5	9	83	12	108
Joe Frey	8	9	56	1	129
J. W. Henderson	2	9	59	51	80
Average	4	7½	58.6	28.9	89.3

Energy consumption records were kept on eight refrigerators located on cooperating farms. These results are given in Table 6. The average of all refrigerators gave a consumption of 58.6 kilowatt-hours per month for a 7½ cu. ft. box over a period of a year. This represents a cost of $3.82 at the average rates of the farms. All of the refrigerators listed except Mr. Banta's, Mr. Frey's and Mr. Hybarger's were run throughout the year. The consumption is some less during the winter months, but does not vary as much as the weather, since the refrigerators are located inside where heat is used during the winter.

Mr. Hybarger's refrigerator was used only during the hot months, consequently the average consumption is above that of the other boxes: the minimum represents only a part of a month's use. Mr. Banta's refrigerator was used through the entire year with the exception of part of one month during the winter. It was during this month that minimum consumption was registered. Mr. Frey's refrigerator during about eight months of the year was turned on only when refrigeration was desired. During the coldest months it was used only a few days of each month, consequently the average monthly consumption over the year is below what it would otherwise have been. The location of the refrigerator box is quite a factor in the cost of operation. If the box is located in a cool room or on a porch where the sun does not strike, the consumption will be lower than if it is located in a heated room. This is shown in Table 6, by comparing Mr. Schmaltz's refrigerator with the others listed. Mr. Schmaltz's refrigerator is located on an inclosed north porch that is not heated in the winter and is rather cool in the summer.

DOMESTIC WATER HEATERS

With the installation of modern bath and plumbing systems on the farm there has come a demand for some type of water heater to replace the boiler and tea kettle. Where the cooking is done with coal and wood stoves the hot water back of the range is generally used. If a furnace is used in the winter a coil of pipe through the fire pot will supply heat for water. The use of kerosene, gasoline, and electric ranges call for a separate water heater if a large quantity of water is to be heated at reasonable cost. The electric water heater is the most convenient, safest and cleanest of these auxiliary water heaters. The great objection is their high cost of operation at the present price of power; however, in spite of the high cost a good many are being used on farms as the most satisfactory source of heating water.

An electric water heater was installed at Mr. Townsend's during the time records were being kept on the farm. This heater had a tank capacity of 10 gallons, was well insulated and was heated by a three kilowatt temperature controlled heating element. A time clock was placed in the circuit as an experiment for off peak power, and set to turn the power on at 11:00 p. m. and off at 3:00 a. m. A by-pass switch was used when additional heating was desired. It was found that for off peak heating the 10 gallon tank was too small to supply sufficient hot water for the day. Over the 7½ months period that the heater was metered, the average energy consumption was 78.9 kilowatt-hours per month. At the average rate on the farm the cost was $4.19 per month.

WASHING MACHINES

The electric washing machine is one of the most important pieces of labor saving equipment that is used in the farm home. The time required for doing the washing with the electric machine is about one-third that required with the washboard and about one-half that with the hand operated machine. This saving of time often amounts to as much as three hours per week. In addition to the saving of time the hardest of the washing is eliminated, that of rubbing the clothes, or operating the hand machine.

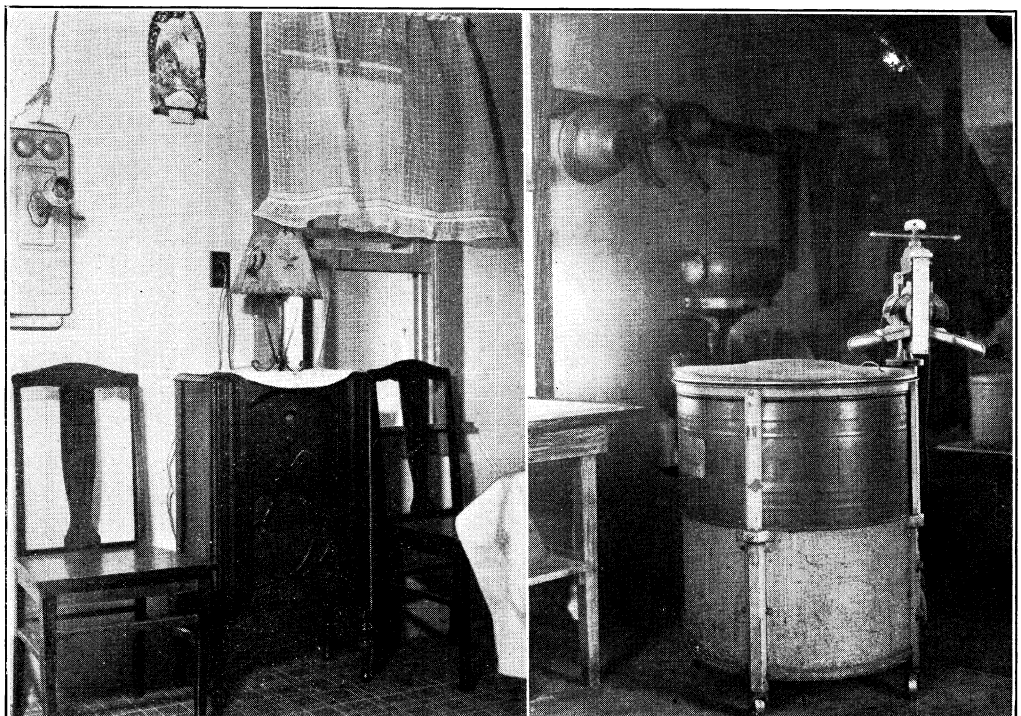
TABLE 7.—Washing Machines Metered on Cooperating Farms

Cooperator	Type machine	People washed for	Kw-hr. per month	Kw-hr. per person per month	Kw-hr. per 10 machines dry clothes
W. H. Shoot	Gyrator	21	8.0	0.38	1.38
Peter J. Schmaltz	Gyrator	4	2.8	0.71	1.50
J. A. Purviance	Gyrator	4	1.8	0.46	1.59
B. L. Odom	Gyrator	7	6.2	0.88	1.37
Joe Frey	Vacuum Cup	8	2.8	0.34	1.47
Average		8.8	4.3	0.55	1.46

Electric washing machines are used on 10 of the 22 cooperating farms. Records were kept on five of the machines. These machines have a capacity of six sheets and are used an average of two hours per month per person. Their cost of operation when compared with the saving of time and labor is almost nothing. The average energy consumption of the machines metered is given in Table 7. The monthly average of all machines over a year was 4.3 kilowatt-hours per month for 8.8 people. The consumption per person per month was 0.55 kilowatt-hours, the consumption per 10 machines of clothes 1.46 kilowatt-hours and the consumption per 100 pounds of dry clothes washed was 2 kilowatt-hours. The average cost per month of operation at the existing rates on the farms was 55 cents for 8.8 people. The washing machine of Mr. Shoot was used for only four months; during this time the washing was done for three families. Mr. Odom's machine was used in washing for two families. The average consumption per family for all machines was 2.7 kilowatt-hours per month, which at the existing farm rates cost 35 cents.

ELECTRIC FLAT IRON

The electric iron is used on every electrified farm. The low first cost of the iron is quickly repaid by the saving of time and fuel. The task of ironing is removed from the burning hot stove to some cooler part of the



Radio and electric washing machine used in the Peter J. Schmaltz home at a cost of 65 cents per month for entertainment and 5.1 cents per person per month for washing.

house, and the time required for ironing reduced from one-third to one-half.

The energy consumption of the electric iron was obtained for a few months on two of the cooperating farms. At Mr. Frey's the average monthly consumption over a three months' period was 8 kilowatt-hours for a family of eight people. At Mr. Hybarger's the average consumption was 6.1 kilowatt-hours for five people. The time required here was approximately 2½ hours per week for the ironing of around 35 pieces. The average for the two farms gave a consumption of 1.1 kilowatt-hours per person per month. This at the existing rates on the farms cost 10.4 cents.

RADIOS

The radio on the farm is a great source of recreation and does much to break the monotony of farm life. Music and entertainment are available to the family that they could not otherwise afford. It provides a personal contact with other people and brings to the farm children some of the attractiveness of city life, making them more content in the wholesome surroundings of the home. The radio is not entirely a luxury for the farm home. The educational programs that are available from the government, colleges and other organizations are of economic value to the farmer. These farm home programs and reports help him solve many problems, with a saving of time and money. The market and weather reports alone often save the farmer many dollars in the marketing of his products and the harvesting of his crops.

TABLE 8.—Radios Metered on Cooperating Farms

Cooperator	Number tubes in set	Average kw-hr. per month
Peter J. Schmaltz	7	8.6
D. C. Hybarger	5	8.0
J. A. Purviance	8	2.6
Average	6.7	6.4

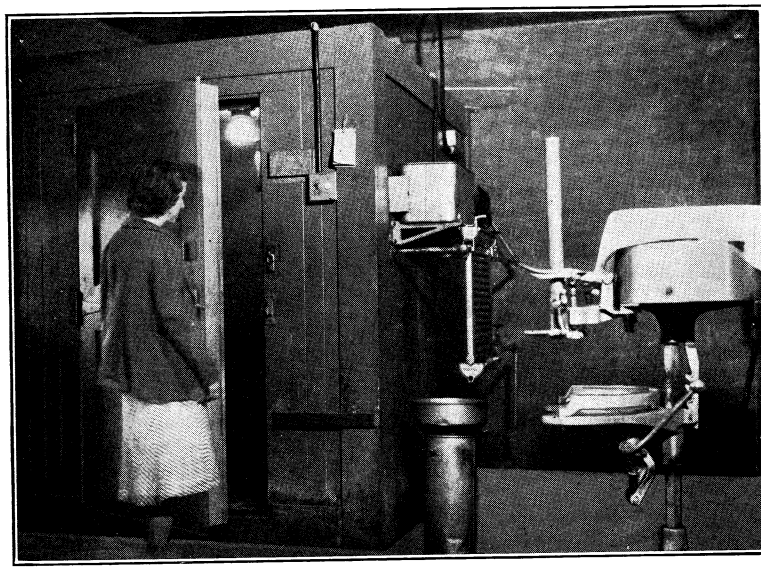
The operating cost of the radio is small, and depends largely upon the tastes and habits of the farmer. The consumption of the radio was metered on three of the cooperating farms. The average consumption of each of these sets is given in Table 8. The average consumption of all radios metered was 6.4 kilowatt-hours per month. At the existing rates on the farms this represents a cost of 57 cents per month. Two of the radios, Mr. Hybarger's and Mr. Purviance's, were not metered throughout the entire year. Mr. Purviance's radio was used principally for educational programs, and for the weather and market reports, consequently the consumption is probably lower than that of most farms.

DAIRY REFRIGERATORS

The demand for high grade milk and strong competition are making the dairy refrigeratior an economic necessity on the dairy farm. City and State Health Departments are enacting rigid regulations controlling the production and sale of milk. They are demanding that the milk sold within their jurisdiction be of high quality and low bacterial count. To keep the bacterial count reasonably low the milk must be cooled down to around 40°F. immediately after being drawn from the cows, and held there in order to prevent the rapid increase of bacteria. In a 24-hour period it has been found that the increase of bacterial count in milk is zero per cent at 32°F., 25 per cent at 36°F., 42 per cent at 42°F., 200 per cent at 50°F., and 500 per cent at 55°F.

In order to cool the milk to 40°F., or lower, either ice or mechanical refrigeration must be used. Mechanical refrigeration with electric power is

the cheaper of the two as well as the more convenient. Around 3.5 kilowatt-hours of electricity is equivalent to 100 lbs. of ice for the cooling of milk. At three cents per kilowatt-hour the equivalent value of ice would be 10½ cents per 100 pounds. To this however should be added the difference in depreciation and interest cost of the two systems. With this addition the resulting saving of electric refrigeration over the cost of ice in many cases will more than pay the electric bill for the entire farm. One farmer in the state who has recently changed from ice for cooling to electric cooling indicated that he is paying his total farm electric bill plus the monthly payments on his refrigerator for what it originally cost him for ice.



A typical dairy refrigerator box in which milk is stored at the C. R. Birks' dairy. On the right side of the box is the aerator over which milk was cooled at an average cost of 6.98 cents per 100 pounds. The refrigerating unit is located under a shed roof outside the milk house.

TABLE 9.—Aerator Brine Pumps on Cooperating Farms

Cooperator	Motor horsepower	Average kw-hr. per month	Kw-hr. per 100 lbs. milk cooled
C. R. Birks	¼	21	0.10
J. A. Purviance	¼	25	0.20
J. W. Henderson	¼	17	0.05
E. K. Gaylord	¼	30	0.15
T. T. Baker	1	40	0.20
Standard Dairy	2	395	0.42
Average	⅔	88	0.19

With electric refrigeration two general systems of cooling are used, the wet and the dry box. In the wet type, the milk is placed in 10 gallon cans and set directly in the brine of the storage tank, where it is cooled and left in storage. In the dry box system the milk is cooled over an aerator

and then stored in a dry refrigerator box, generally of the walk-in type. The wet system has a somewhat lower energy consumption than the dry system and is generally used where the milk is sold at wholesale. Where the milk is sold at retail in bottles the dry box system is used, since cases of bottled milk cannot be stored in the wet type box.

TABLE 10.—Specifications of Dairy Refrigerators on Cooperating Farms

Cooperator	Size unit tons ice	Size box feet	Storage space cu. ft.	Gallons brine	Compressor motor hp.
C. R. Birks	½	5x6x6	130	375	1
John Hudman	½	5x6x6	130	375	1
J. A. Purviance	½	5x6x6	130	375	1
J. W. Henderson	½	5x7x7	190	335	1
E. K. Gaylord	1	5x6x6	180	300	1½
T. T. Baker	2	9x11x6	500	600	5
Standard Dairy	5	11x14x10	1080	470	10
Average	1.4		334	404	2.9

TABLE 11.—Dairy Refrigerators on Cooperating Farms

Cooperator	KILOWATT-HOURS PER MONTH*			Kw-hr. per 100 lbs. milk cooled	Average lbs. cooled per day	Average lbs. in storage continuously
	Average	Maximum	Minimum			
C. R. Birks	372	513	223	1.71	712	179
John Hudman	380	537	187	2.19	570	187
J. A. Purviance	377	529	71	2.98	413	211
J. W. Henderson	428	603	109	1.49	1137	326
E. K. Gaylord	832	1202	498	4.22†	646	162
T. T. Baker	786	1228	466	4.03	640	337
Standard Dairy	2210	3305	1597	2.37	3052	655
Average	769	1131	450	2.71	1024	297

* Aerator brine pump included.

† 25 pounds of ice was frozen for each 100 pounds of milk cooled.

Records were kept throughout a year on seven dairy refrigerators. These refrigerators are all of the dry box type. The milk is cooled over aerators, by means of brine circulated through them with rotary pumps. The motor sizes of the aerator brine pumps and their consumptions are listed in Table 9. The average consumption of all the pumps metered was 0.19 kilowatt-hours per 100 pounds of milk cooled. The specifications of the refrigerators metered are given in Table 10 and the average records in Table 11. The consumptions of the aerator pumps given in Table 9, are also included in the refrigerator consumptions given in Table 11.

The first four refrigerators listed have a ½-ton ice duty capacity per 24 hours, and are an ideal size for a farm where it is desired to cool from 50 to 150 gallons of milk per day. Referring to Table 11, it may be seen that the consumption of these units per 100 pounds of milk cooled varies indirectly as the amount of milk cooled per day. This indicates that if low operating cost is desired the refrigerator should not be larger than is needed. The first three of these refrigerators are air cooled methyl-chloride units while the fourth is a water cooled sulphur dioxide unit. Mr. Purviance's refrigerator was not used for about two months during the winter and Mr. Henderson's was not used for about 2½ months except to provide cold stor-

age for milk that was cooled by pond water, consequently the yearly average consumption of these two refrigerators per 100 pounds of milk cooled is above what it would otherwise have been.

Mr. Gaylord's refrigerator is a 1-ton methyl-chloride air and water cooled unit. In addition to the cooling of milk, 25 pounds of ice was frozen for each 100 pounds of milk cooled, consequently the energy consumption of 4.22 kilowatt-hours per 100 pounds of milk cooled, for this refrigerator, is high.

Mr. Baker's and the Standard Dairy's refrigerators are water cooled ammonia units. During the first month of the year's operation Mr. Baker's machine was used for freezing ice in addition to cooling milk, thereafter it was used at a low per cent of capacity, consequently the energy consumption per 100 pounds of milk cooled is high.

The average consumption of all the refrigerators metered, per 100 pounds of milk cooled, was 2.71 kilowatt-hours. This represents a cost of 10.8 cents per 100 pounds of milk cooled at the existing rates on the farms. The consumption of 2.71 kilowatt-hours per 100 pounds of milk cooled is probably somewhat high for the average refrigerator, since this value includes the consumption of one refrigerator where ice is frozen and the consumption of another one that is operated at a low per cent of capacity. The average consumption for five of the refrigerators was 2.15 kilowatt-hours per 100 pounds of milk cooled. This figure represents a more true average of the consumption that may be expected in Oklahoma.

MILKING MACHINES

The milking machine lightens one of the most dreaded chore jobs of the farm. The hard labor is eliminated and the time required for milking is decreased. The time saved depends upon the number of cows milked and the method of washing the machine. The time required for washing the machine by the brush method is four or five times as long as by the suction method. For a herd smaller than 10 to 15 cows the milking machine, as a rule, is not a paying proposition. The saving in time for less than 10 cows is practically nothing. For herds from 15 to 30 cows the saving of time will run from 30 to 50 per cent. With larger herds the saving is even greater. The increased number of cows that one man may handle is one of the greatest advantages of the milking machine. One man can milk about 15 cows by hand and around 30 cows with a two unit milking machine. This makes it possible on a 30-cow dairy to eliminate the hired man who is not needed except at milking time. The two to four unit machines are the sizes generally used on most Oklahoma farms. Two units are about as many as can be handled where one man does the milking. Where two men do the milking the four unit machine is desirable.

Records were kept on seven milking machines throughout a year. The cooperating farms and the avcrage record of each machine are given in Table 12. All of these machines except Mr. Birks' were of the pipe line type. Mr. Birks' machine is of the drive rod type.

The energy consumption varies widely depending upon the type of machine, the per cent capacity used, the season and the cows milked. The consumption of the pipe line type is somewhat higher than other types as a general rule. If all the units of a machine are not used, the cost of operation per cow will be decidedly increased. The energy consumption per cow per month will generally be greater during the winter months when the cattle are on dry feed. The variation in amount of milk drawn from the cows is not the controlling factor of the energy consumption. The consumption will often be higher for cows nearly dry that are giving a small amount of milk than for cows just fresh that are giving a large amount of milk.

TABLE 12.—Milking Machines on Cooperating Farms

Cooperator	Motor hp.	Milking units	Average number cows milked	Average kw-hr. per mo.	Average kw-hr. per 100 lbs. milk	Average kw-hr. per cow per mo.
Roy Bozorth	½	2	25.0	41.	3.50	1.62
Roy Kneeland	½	2	29.3	57.	4.72	1.94
C. R. Birks	½	3	31.0	40.	1.84	1.29
J. W. Henderson	½	3	57.5	80.	1.92	1.40
John Hudman	1	4	29.5	70.	4.03	2.37
Standard Dairy	1	4	60.0	69.	1.56	1.14
J. A. Purviance	3	6*	29.7	250.	18.10	8.43
Average	1	3.4	37.4	87.	5.10	2.60

* Only two units are used.

Mr. Purviance's milking machine has the capacity for six units. During the year's operation only two of these units were used. Consequently the consumption of 8.43 kilowatt-hours per cow per month is several times higher than it should have been. The average of all machines gave a consumption of 87 kilowatt-hours per month, for the milking of 37.4 cows. The average consumption per 1000 pounds of milk drawn was 5.10 kilowatt-hours and the consumption per cow per month was 2.6 kilowatt-hours. At the existing rates on the farms the cost of operation per cow per month was 11.7 cents. The average values given in the table are probably somewhat high, since they include one large machine that was not operated to full capacity. The average of six machines gives a monthly consumption of 59.5 kilowatt-hours for 38.7 cows, a consumption of 2.93 kilowatt-hours per 1000 pounds of milk drawn and a consumption of 1.63 kilowatt-hours per cow per month. This consumption is more in line with what may be expected of the small milking machines used on Oklahoma farms.

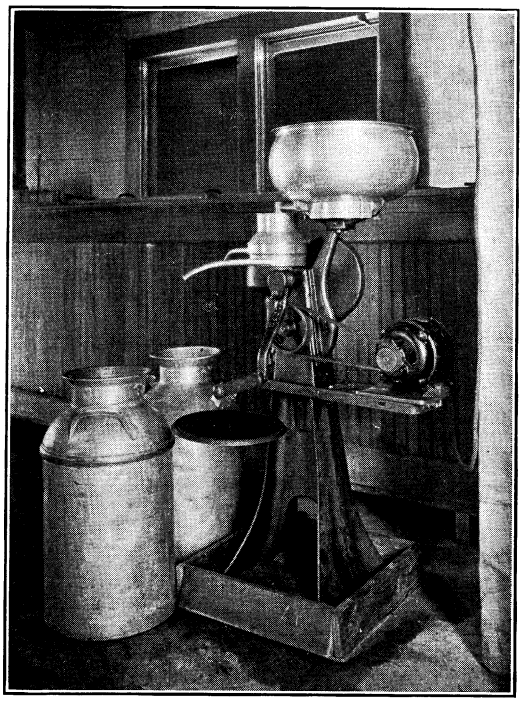
CREAM SEPARATORS

The cream separator is used both on farms that sell milk and on farms that sell butterfat in the form of cream or butter. The customers of the retail milk dairies use some cream which they expect their milkman to supply. The cream supplied to such customers should be of uniform quality. The constant speed of the electrically driven separator makes it ideal for supplying cream of a uniform quality. For the dairyman who sells his products as cream the electric separator is a saver of butterfat since the speed can not fall below the minimum required for the separation of cream and milk. Cream of uniform butterfat content often sells at a premium, and has the advantage where churned of producing a better grade of butter. The saving of the time and labor required for separating by hand will pay the small operating cost of the electric separator. The electric separator may be left running unattended while the milking is being done and the milk separated in bucketfuls as it is drawn from the cows. The time required for separating is saved in this way. If the milk is not drawn from the cows as fast as the separator will handle it, the cost of operation will be higher than if the machine was operated at full capacity. The increased cost, however, will be small in comparison to the saving of time.

Records were kept on two separators located on cooperating farms. The averages of these records are given in Table 13. The mean monthly consumption of the two separators was 5.9 kilowatt-hours for an average of 351 pounds of milk per day. The average consumption per 1000 pounds of milk separated was 0.61 kilowatt-hours. At the power rates existing on the farms the average cost per month of operation was 18 cents and the average cost per 1000 pounds of milk separated was 1.91 cents.

TABLE 13.—Electrically Operated Cream Separators Metered on Cooperating Farms

Cooperator	Size separator lbs. per hr.	Motor horsepower	Average kw-hr. per month	Average lbs. separated per day	Kw-hr. per 1000 lbs. milk separated
T. T. Baker	500	¼	6.4	255	0.83
Standard Dairy	500	⅛	5.4	447	0.39
Average	500	.21	5.9	351	0.61



The back breaking labor of separating milk is eliminated at the T. T. Baker dairy at a cost of 2.95 cents per 1000 pounds of milk.

Both of the separators metered were used on retail milk farms to supply cream for customers and for separating the surplus milk. For part of the year Mr. Baker's separator was run during the time of milking at only about one-half capacity, consequently the energy consumption of 0.83 kilowatt-hours per 1000 pounds of milk separated is higher than it otherwise would have been. The average consumption of cream separators from all states reported, as given by the National C. R. E. A. in Electricity on the Farm, Volume VII No. 1, is 0.48 kilowatt-hours per 1000 pounds of milk separated. The consumption of 0.61 kilowatt-hours per 1000 pounds of milk separated, obtained from the two separators metered on cooperating farms, is above the national average. This difference no doubt is due to the fact

that one of the separators included in the average of Table 13 was not operated at full capacity for part of the year.

BOTTLE WASHERS

The bottle washer is a great saver of time for the dairyman retailing his milk in bottles. The bottles are not only washed in less time but are washed better with the machine than by hand.

TABLE 14.—Bottle Washers Metered on Cooperating Farms

Cooperator	Motor horsepower	Average kw-hr. per month	Average bottles washed per day	Kw-hr. per 1000 bottles washed
E. K. Gaylord	¼	5.0	663	0.25
John Hudman	¼	2.0	270	0.24
T. T. Baker	¼	6.8	520	0.43
Average	¼	4.6	484	0.31

In Table 14 are given the average records of three bottle washers on cooperating farms. The mean monthly energy consumption of the three was 4.6 kilowatt-hours for the washing of an average of 484 bottles per day. The consumption per 1000 bottles washed was 0.31 kilowatt-hours. At the average power rates on the farms the cost per month was 20 cents and the cost per 1000 bottles washed was 1.3 cents. The average time required for washing the bottles was one hour per each 400 bottles washed.

The bottle washer at Mr. Gaylord's was a commercial washer with three rotating brushes, for the washing, inside and out, of two bottles at a time. Mr. Hudman's bottle washer is a steam driven washer that had been converted to electric operation by the use of a ¼ horsepower motor connected through a belt drive. It consists of only one rotating brush. At Mr. Baker's a ¼ horsepower motor with brush attached direct to the shaft is used for washing the bottles. A high resistence ground in this motor caused the energy consumption to be high for several months, consequently the consumption of 0.43 kilowatt-hours per 1000 bottles washed is high for the washer.

MISCELLANEOUS DAIRY EQUIPMENT

The dairy equipment heretofore discussed is that generally found in the majority of dairies. Other equipment such as sterilizers, water heaters, churns, bottling machines, pasteurizers, motor-driven agitators, etc., are used in some of the larger dairies with a saving of time and expense. A few pieces of such equipment were used in individual cases on the cooperating farms.

At the Standard Dairy an electric driven bottling machine, churn, pasteurizer agitator, cooling can agitator, and starter can agitator, were used in addition to the equipment previously discussed.

The bottling machine is a continuous cycle combined bottler and capper, has a 150 gallon per hour capacity and is driven by a ½ horsepower motor. The average consumption over 11 months operation was 3.4 kilowatt-hours per month, 0.19 killowatt-hours per 1000 bottles, and 0.10 kilowatt-hours per 1000 pounds of milk bottled. The average time required for bottling was 45 minutes per day for 592 bottles which consisted of quarts, ⅓ quarts, pints and ½ pints. At the average farm rate the cost of operation was 7 cents per month, 0.4 cents per 1000 bottles, and 0.23 cents per 1000 pounds of milk bottled.

A small electric churn of the drum type, driven by a ½ horsepower motor, was used for 2 months during the time records were kept. The

energy consumption of this churn per 100 pounds of butter churned was 2.09 kilowatt-hours.

The agitator of the 200 gallon steam spray pasteurizer was driven by a ½ horsepower electric motor. The agitator was used on an average of two hours per day during the pasteurizing of an average of 1470 pounds of milk. The average monthly energy consumption was 14.2 kilowatt-hours the cost of which was 30 cents. The consumption per 1000 pounds of milk pasteurized was 0.32 kilowatt-hours, the cost of which was 0.67 cents.

The milk, after being drawn from the cows, was cooled by brine circulation around a 150 gallon cooling can and held over until pasteurized. The agitator of the can was driven by a ¼ horsepower electric motor. The average consumption of the agitator was 13.1 kilowatt-hours per month or a consumption of 0.28 kilowatt-hours per 1000 pounds of milk cooled. At the prevailing farm rate the cost of operation was 28 cents per month or 0.61 cents per 1000 pounds of milk cooled.

The starter can was used during part of the year in making buttermilk and for warming milk to be separated. The can had a capacity of 150 gallons and was equipped with an agitator driven by a ¼ horsepower motor. During the time that this can was in use the agitator was run about 2 hours per day for the warming of around 570 pounds of milk. The energy consumption per month varied since the can was not used regularly during the month. The average consumption of all months in which the can was used was 3.9 kilowatt-hours per month the cost of which was 9 cents.

At Mr. Gaylord's dairy the refrigerator box is cooled by brine circulated through refrigerating coils by an electric motor, and the hot water boiler temperature is controlled by electric equipment.

Due to the ice making equipment the refrigerator brine tank is located outside the storage box or cold room. Because of this, a brine circulator must be used to cool the refrigerator box. This circulator consists of a ¼ horsepower motor and rotary pump controlled by the cold room thermostat. The consumption varies widely with the season of the year as may be seen from the curve of the farm. The average consumption for 12 months' operation was 41 kilowatt-hours per month the cost of which was $2.13.

The fuel feed and the temperature of the oil fired hot water boiler is controlled by a ⅛ horsepower motor and relays. The average consumption of this control equipment throughout the year averaged 14 kilowatt-hours per month, the cost of which was 76 cents.

ELECTRIC INCUBATORS

Electricity is a safe, convenient and reliable source of energy for the operation of incubators. The electric incubator can be used to an advantage by both the commercial poultryman and the general farmer.

Incubators from 200- to 600-egg capacity are being successfully used by farmers who wish to hatch their own chicks. These small incubators require little attention and the danger of fire is small. The temperature is held constant by a reliable temperature control, consequently the efficiency of hatching, where the proper humidity is maintained, is as high as that of large incubators. Since the humidity is not readily controlled, the tendency is to supply too little moisture with the result that the percentage of hatching is lowered.

On the commercial poultry farms electric incubators of 5000-egg capacity and up are being successfully operated in competition with other types of incubators. These electric incubators have the advantage of constant heat control at the desired temperature and are not subject to air

contamination since forced ventilation is available. The absolute and constant control of air movement, moisture and heat gives more consistent and generally higher percentages of hatches of strong healthy chicks than other types of incubators.

The energy consumption of the electric incubator depends largely upon the size of the incubator and the insulation. This consumption will vary from 200 kilowatt-hours per 1000 eggs incubated for small, poorly insulated incubators to as low as 25 kilowatt-hours per 1000 eggs incubated for large, well insulated incubators. The cost of electricity for operation of the electric incubators will probably be somewhat greater than the cost of oil for the oil incubator, but the greater per cent hatch, the saving of time for attention, and the decreased fire hazard of the electric incubators will more than compensate for the difference in operating cost.

TABLE 15.—Electric Incubators on Cooperating Farms

Cooperator	Eggs capacity	System of heat	Source of ventilation	Per cent of fertile eggs hatched	eggs Kw-hr. incubated per 1000	Kw-hr. per 1000 chicks hatched
Peter J. Schmaltz	416	Electricity	Natural	66.3	157.4	296.0
George Smith	15,000	Electricity and gas	Electric	58.9	47.9	101.6
Charles H. Rodieck	16,000	Electricity	Electric	84.0	40.8	57.1
W. H. Shoot	42,000	Electricity	Electric	61.2*	51.2	83.7

* Per cent of total eggs hatched.

In Table 15, are given the averages of records kept on four incubators.

Mr. Schmaltz used a small capacity incubator such as is common on general farms. It consists of two 208-egg flat top radiant heat units. These units were located in an upstairs room that was not heated. Records were kept on the incubator for two seasons, during which eight hatches were made. In this time 66.3 per cent of all the fertile eggs set were hatched. The per cent hatching varied from 48.3 to 88.6. Some of the low per cent hatches were due to a faulty thermometer which resulted in the temperature being held at an incorrect value. The average energy consumption per hatch was 65.5 kilowatt-hours. Since the incubator was located in an unheated room, the consumption of the hatches varied widely from the first to the last of the season. The cost of electricity per hatch was $4.50 at the average rate during the time the incubator was used. The average cost per 1000 eggs incubated was $10.81, and the average cost per 1000 chicks hatched was $20.33.

Mr. Smith's incubator consists of three 5000-egg cabinet type units. The bulk of the heat is supplied from hot water heated by gas. The final heat for temperature regulation is obtained from automatically controlled electric heating elements. Forced ventilation is secured by electrically driven fans. The incubator was located in a room, the temperature of which was held at from 70°F. to 80°F. during the hatching season. Records were kept through one hatching season. During this time 58.9 per cent of the fertile eggs were hatched. The average percentage of hatch is low due to the fact that during the heaviest month of hatching the humidity within the incubator was low because of a faulty hygrometer. The electric energy consumption of the incubator was 47.9 kilowatt-hours per 1000 eggs incubated, the cost of which was $2.31. Since the bulk of the heat is supplied by gas, the cost of the gas should be added to this in order to obtain the total cost of fuel.

Mr. Rodieck's incubator is a 16,000-egg cabinet type electrically heated and ventilated machine. It is operated for twelve months of the year and is located in a room that is heated to around 70°F. during the cold months and is left unheated during the warm months. During the year that records were kept, 84 per cent of the fertile eggs were hatched. The percentage of hatching varied over the seasons of the year, it being the lowest in the summer months and the highest in the spring of the year. The average monthly consumption for the year was 508 kilowatt-hours. The average consumption per 1000 eggs incubated was 40.8 kilowatt-hours. Since the incubator was operated through the hot summer months the average consumption should be lower than if it were operated only during the regular hatching season. This difference however, is more than offset by the low capacity operations during part of the year. The energy consumption cost was $1.64 per 1000 eggs incubated, or a cost of $2.30 per 1000 chicks hatched.

Mr. Shoot's incubator capacity consisted of three electrically heated and ventilated cabinet type units. Two of these have capacities of 17,000 eggs, while the third has a capacity of 8,000 eggs. The incubators were located in a room the temperature of which was held around 70°F. during the hatching season. The eggs were not candled during the season that records were kept, consequently the per cent hatch given in Table 15 is the per cent of the total eggs that were hatched instead of the per cent of the fertile eggs hatched that is given for the other incubators. The energy consumption per 1000 eggs incubated was 51.2 kilowatt-hours, the cost of which was $1.95. The energy consumption per 1000 chicks hatched was 83.7 kilowatt-hours which cost $3.19.

ELECTRIC BROODERS

Electricity is a convenient and safe source of heat for brooding chicks on the farm. The decreased fire hazard, the constant temperature, and the saving of labor is being recognized by the poultryman as of sufficient value to compensate for the difference in fuel cost of the electric brooder over that of other types. On the general farm where only a few chicks are brooded the reliability and constant temperature control of the electric brooder saves the farmer the trouble of rising during the night to look after the chicks. This convenience is appreciated, and is doing much to replace the coal and oil brooders on electrified farms.

The electric brooders are of two general types, the battery type and the hover type. The battery type is used chiefly in commercial poultry plants and hatcheries for the storage and display of baby chicks. They have the advantage over other brooders of large storage capacity for a small space, since they are made in sections with the sections placed in tiers one above the other. The hover type brooders are used on the general farms in from 200 to 500 chicks sizes as a rule. They are placed on the floor of the brooder house that may or may not be heated, and the chicks allowed to run out from under them for feeding and back at their own leisure.

The energy consumption of the electric brooder will depend upon the kind of brooder, the insulation of the brooder, the brooder room temperature, the season of operation and the length of the brooding season. This consumption will vary from 0.25 kilowatt-hours per chick brooded to as high as 2 kilowatt-hours per chick brooded. For a well insulated brooder under average conditions, the energy consumption should not be above one kilowatt-hour per chick brooded.

Records were kept on two electric brooders used on cooperating farms. The brooder used at Mr. MacArthur's farm was of the battery type with a capacity of 500 chicks. The brooder consisted of 10 sections, 6 of which were used during the month of May for the brooding of 150 chicks. Since the six sections were used at only one-half capacity the energy consumption is higher than it would otherwise have been. The brooder was held

at 90°F., and was located in a room, the temperature of which was about 70°F. The chick mortality was 13.3 per cent. The energy consumption for the month was 119 kilowatt-hours, a consumption of 0.85 kilowatt-hours per chick.

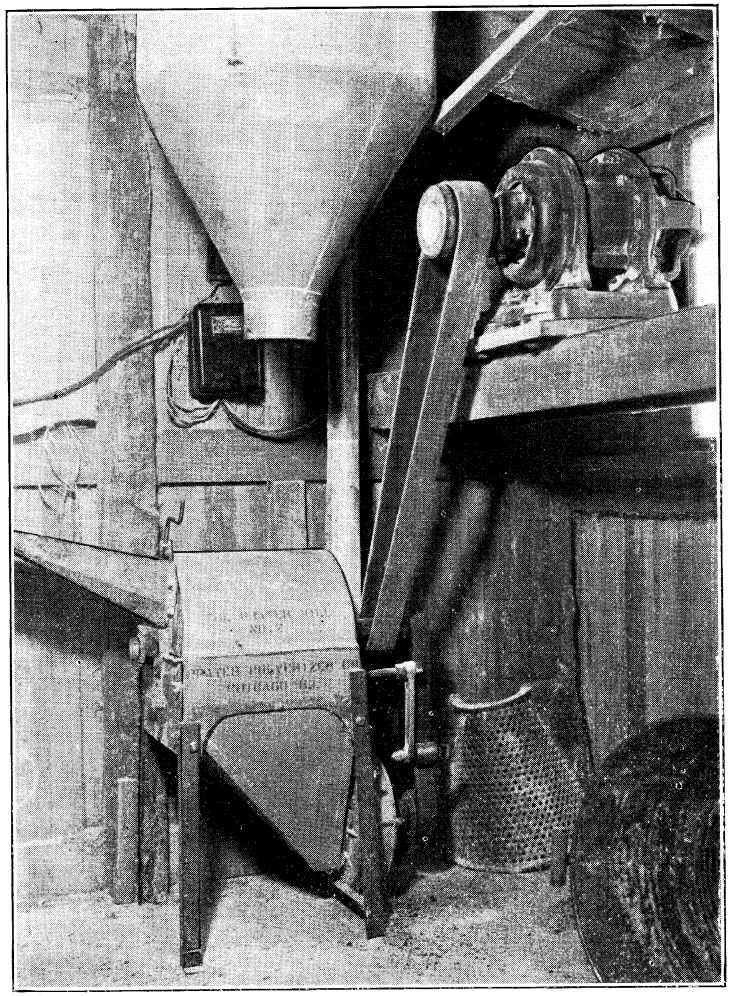
At Raymond Purviance's a home-made, hover type underheat brooder, with a capacity of around 300 chicks, was used during the month of May for brooding an average of 210 chicks. The brooder was held at 85°F. by thermostatic control and was located in an unheated brooder house. The brooder was not used continuously throughout the month, but was turned on only when the heat was needed. The chick mortality was 11 per cent and the energy consumption was 0.54 kilowatt-hours per chick brooded.

FEED GRINDING

Grinding grain for dairy cows is recognized by all authorities as an economic necessity. It is believed by many that the processing of roughage and the grinding of grains is a paying proposition for other livestock as well as for dairy cattle. Feed processing increases the digestibility, and in the case of roughage decreases the waste of feed that is pulled out of the feed rack and trampled under foot. The processing of feed on the farm makes possible the use of home grown feed without the expense of hauling it to and from a custom grinder. On electrified farms the electric motor has proven a satisfactory source of power for operation of the small size feed grinders that are commonly used on the farm. The cost of grinding will be materially lower than the cost of custom grinding where sufficient feed is ground to justify the overhead cost of the grinder. The necessity of limiting the cost of rural lines makes it undesirable to build a line with a capacity for more than a 7½ horsepower motor on the farm. The 7½ horsepower motor is sufficient power to grind all feed consumed on the farm. With automatic operation a ¼ horsepower motor with small burr mill will grind the grain required by a herd of 60 dairy cows. Where roughage is ground the 5 to 7½ horsepower motor should be used. The hammer and burr type mills are the ones generally used on the farm. A number of these mills are equipped with knives or swinging discs for the processing of roughage. The first cost of the burr mill is generally lower than that of the hammer mill, but the replacement of burrs and the liability of damage from foreign objects and idle running make the upkeep higher than that of the hammer mill. The efficiency of grinding is higher for the burr mill where coarse grinding is done and higher for the hammer mill where fine grinding is done. For this reason the hammer mill is preferred for fine grinding and the burr mill for coarse grinding. Between these two extremes there seems to be little difference in the efficiencies of the mills.

The energy consumption and capacity of grinding depends upon the make of mill, the fineness of grinding and the kind of feed. With an increase in fineness of grinding, the energy consumption increases rapidly and the rate of grinding decreases. Hard, brittle grain, such as corn, wheat and kafir, is more easily ground and requires less energy than grain of higher fiber content such as oats. According to information secured from the National C. R. E. A. Report, Vol. VII No. 1, the rate of grinding oats to medium fineness will average around 130 pounds per hour per horsepower and the rate for shelled corn, around 400 pounds per hour per horsepower. The energy consumption for oats will vary from 0.5 to 2 kilowatt-hours per 100 pounds ground and the consumption for corn will vary from 0.1 to 1.0 kilowatt-hours per 100 pounds ground. During a Rural Electrification Short Course held at the college in 1931, records of energy consumption and rates of grinding were taken on three different grinders. These results are given in Table 16. Grinder No. 1 is a hammer type mill with swinging discs for

processing roughage, No. 2 is a combination cutter and burr mill, and No. 3 is a hammer mill. Each mill was equipped with elevating fan and dust collector. During the tests, mills No. 2 and No. 3 were driven by a 5 horsepower motor while No. 1 was driven by a 7½ horsepower motor. The rate of feeding was regulated so as not to overload the motors. Records were kept on the feed grinders of cooperating farmers. The averages of these records are given in Table 17. The average consumption of all the grinders per 100 pounds of feed ground was 0.8 kilowatt-hours, the cost of which was 4.9 cents at the rates paid by the farmers. The feed ground consisted of grain and roughage, most of which was ground to medium fineness.



Mr. Peter J. Schmaltz does his own feed grinding with a small hammer mill and a 3 horsepower motor at a cost of 6.41 cents per 100 pounds.

TABLE 16.—Rural Electrification Short Course Grinding Results

Grinder No.	Kind of feed	Modulus of fineness	Rate of grinding lbs. per hr.	Kw-hr. per 100 lbs. feed ground
1	Kafir	2.929	1974	0.38
1	Snapped corn	3.64	860	0.84
1	Corn and darso fodder	3.21	740	1.00
2	Snapped corn	3.914	796	0.59
3	Wheat		2193	0.20
3	Oats		908	0.55

TABLE 17.—Feed Grinding on Cooperating Farms

Cooperator	Type mill	Motor hp.	Kind of feed	Pounds per hr.	Fineness	Kw-hr. per 100 lbs.
I. F. Melrose	Burr	5	Grain	1060	Medium	0.63
John Hudman	Hammer	7½	Grain	860	Medium fine	0.76
Roy Kneeland	Burr	5	Grain and roughage	200 to 1400	Fine to coarse	0.71
J. A. Purviance	Hammer	7½	Grain and roughage		Fine	1.05
Peter J. Schmaltz	Hammer	3	Grain	500	Fine	0.84
Average		5.6				0.80

Mr. Melrose's grinder is a burr type mill equipped with a bucket elevator. The grain ground during the year consisted of 52 per cent oats, 29 per cent ear corn and the remainder barley and a small amount of milo. Some was ground rather fine but the greater part medium.

Mr. Hudman's grinder is of the rigid hammer type and was operated without an elevator. The feed ground during the year consisted of 57 per cent oats, 36 per cent head kafir, and the remainder wheat. The fineness of grinding varied from coarse to fine, but the greater part was medium.

Mr. Kneeland's machine is a combination cutter and burr mill equipped with a fan elevator and dust collector. The mill was used for processing both roughage and grain. Sheaf oats and beets were put through the mill with the burrs open allowing the knives to do most of the processing. The fineness of grinding for grain varied from fine to medium coarse with the bulk being ground medium fine. The total feed ground consisted of 31 per cent sheaf oats, 31 per cent beets, 16 per cent threshed oats, 15 per cent kafir and the remainder corn with a small amount of alfalfa and wheat. The energy consumption of this type of mill is greatly increased if the burrs and knives are allowed to become dull. In the farm records the effect of changing burrs and sharpening knives may be seen. The energy consumption per 100 pounds ground was around 1.2 kilowatt-hours during the winter months, the knives were sharpened during March and the consumption dropped to 0.76 kilowatt-hours in April, the burrs were replaced with new ones and the

consumption dropped to .48 kilowatt-hours per 100 pounds of feed ground.

Mr. Purviance used two different grinders during the time records were kept. One of these was a large hammer type roughage mill of an old model, the other was a small recent model hammer mill equipped with cobb crusher. An elevating fan was not used on either mill. The difference in energy consumption of mills may be seen from the farm record of these two mills. The consumption per 100 pounds of feed ground was 1.4 kilowatt-hours for the old mill and 0.88 kilowatt-hours for the new mill. The total feed ground consisted largely of roughage, 81 per cent sheaf oats, 16 per cent sheaf wheat and the remainder alfalfa, corn and threshed oats. Most of the feed was ground rather finely.

The feed grinder used by Mr. Schmaltz was a small hammer mill equipped with fan elevator and dust collector. The total feed ground during the year was 49 per cent oats, 41 per cent corn and the remaining part wheat. Two screens were used, a ½ inch and a ⅛ inch. Most of the grain was ground rather fine since the ⅛ inch screen was used the greater part of the time.

ENSILAGE CUTTER

The 5 and 7½ horsepower motors are being successfully used for filling silos up to 40 feet in height. The time required to fill the silo is greater than that required with larger power units, but the number of men required is less. On many farms the silo can be filled by the regular farm help with considerable saving in expense, since a crew of from two to five men is sufficient. The rate of cutting will vary from two to ten tons per hour depending upon the make of cutter, the cutter speed, the condition of knives, the carefulness of feeding and the condition of the silage. The 9 to 13 inch throat flywheel type cutter is considered the best for electric motor drive. Two or three knives are used, depending upon the length of cut desired and the feeder speed. The knives should be kept sharp and close to the shear plate. The most important consideration in operating an ensilage cutter with a 5 to 7½ horsepower motor is a low cutter speed. The elevating fan requires such excessive power at the high speeds ensilage cutters commonly operate, that little power is available for cutting with a small motor. During a Rural Electrification Short Course held at the College in 1931, a no-load test was conducted on an ensilage cutter with a calibrated motor. Results of this test show that the power input to the cutter was 5.25 hp. at 800 R.P.M., the speed at which the cutter is commonly run, and a power input of 1.16 hp. at a speed of 450 R.P.M. which was found sufficient to elevate into a 40 foot silo.

The capacity of the cutter is not reduced in proportion to the speed since additional knives may be used and the feeder speed increased. Since excessive power is not required to drive the elevating fan, the energy consumption per ton of ensilage cut is materially reduced.

TABLE 18.—Silo Filling on Cooperating Farms

Cooperator	Motor hp.	Tons silage cut	Kw-hr. per ton
John Hudman	7½	105	1.63
Roy Kneeland	5	30	2.87
J. A. Purviance	7½	210	1.65

Ensilage cutting was done on three cooperating farms with small electric motors. The results of records taken are given in Table 18. Corn and sorghum were cut for silage at each of the farms. The silage was elevated into a 30-foot silo at Mr. Hudman's, and into pit silos that extended 10 to 15 feet above the ground at Mr. Purviance's and Mr. Kneeland's. The cutting was done with ensilage cutters at Mr. Purviance's and Mr. Hudman's and at Mr. Kneeland's with a combination cutter and burr mill, so con-

structed that the ensilage fell from the knives directly into the elevating fan. The energy consumption varied from 1.63 kilowatt-hours per ton of ensilage to 2.87 kilowatt-hours per ton. This consumption is higher than that generally found where the knives are kept sharp and the cutter is operated at the most efficient speed. According to information secured from the National C. R. E. A. Bulletin, Electricity on the Farm, Vol. VII, No. 1, the consumption will vary from 0.6 to 1.0 kilowatt-hour per ton of ensilage. Sorghum ensilage which is commonly used in Oklahoma will require more power than corn ensilage, consequently the consumption will be near the upper limit.

THE FARM SHOP

Electricity in the farm shop is a valuable saver of time and labor. Through its use a convenient source of power is available for operation of lathe, drill press, tool grinder, buffer, circular saw and other power shop equipment. These enable the farmer to do much of his repair work, and to sharpen tools and equipment at home instead of taking them to town.

The electricity consumption of the farm shop motor is very small. A one horsepower motor was used in Mr. Phillip's farm shop with an average monthly energy consumption of 1.2 kilowatt-hours. It drives an emery wheel and buffer.

STOCK TANK WATER HEATER

Water heaters are used by some farmers for the stock tank during the winter months to prevent the water from freezing and to induce the stock to drink more water. Larger consumption of water by stock results in greater gains and increased milk production.

The electric water heater is being used successfully by a good many farmers. On Mr. MacArthur's farm a one kilowatt immersion type heater is used in a small uninsulated tank to prevent the water from freezing. The consumption for the winter of 1931-32 was 265 kilowatt-hours. The heater was controlled by hand and used only during freezing weather. The indicated consumption is probably below the average since the winter of 1931-32 was rather mild.

INDIVIDUAL LIGHTING PLANTS

The individual lighting plant is an important source of electrification for farms in Oklahoma and will continue to be so in the future. The 1930 census for Oklahoma reported slightly more than 4,000 individual lighting plants on farms in the state. This represents approximately one-half of the farms that were electrified at that time. For isolated farms where central station service is not available at reasonable cost the individual plant is being used to supply the conveniences of electricity. The plants generally used vary in size from 300 watts to 3,000 watts, the most common size being the 800 watt and the 1500 watt. The voltage generated is either 32 or 110. Due to the high cost of the 110 volt battery which requires 56 cells, the plants with batteries are generally 32 volt which require only 16 cells, while the plants without batteries are 110 volt. The service supplied by these plants is sufficient for lights, most house appliances except range and water heater, and for small motors.

Individual electric lighting systems are of three kinds, small hydroelectric plants, wind electric plants, and engine driven plants.

The hydroelectric plants are limited to individual cases where water power is available. Except in ideal locations the first cost of installation is generally prohibitive. In special cases where there is sufficient power the year around and the cost of installation is low the hydroelectric plant will furnish a reliable source of power at reasonable cost. In Oklahoma such ideal locations are few, consequently the small hydroelectric plant is not an important source of electrification in the state.

The wind electric plant is winning favor in localities where the wind is sufficient for their operation. These plants are being used successfully in Oklahoma where only a small amount of power is desired. The plants usually are storage battery type with generator mounted on a 50 to 60 foot tower and driven by an aeroplane type propellor. In Oklahoma A. and M. College Engineering Experiment Station Publication No. 10, Oklahoma Wind Electric Power, are given the results of tests on a 1 kilowatt plant. The power generated for this size installation based on average wind conditions of Oklahoma City may be expected to vary from 70 kilowatt-hours in August to 205 kilowatt-hours in March. The useful power available from the battery will be considerable lower than the generated power. The power available from such plants will generally be sufficient for lights and small household appliances. The greatest objection to the wind electric plant is the high upkeep of batteries. A storage battery larger than is commonly used with engine driven plants is required in order that power may be available during periods of low wind velocity. Due to battery depreciation and high first cost, the fixed cost of the plant is rather high. This high fixed charge of an apparent low cost power supply increases the power cost until it may be higher than that from other sources.

The engine driven plants are of two general types, the battery and the non-battery. With the battery type the engine driven generator charges the battery and the battery supplies the electric energy. With the non-battery type the energy is taken directly from the generator, consequently the engine must run during the time service is desired. The non-battery type is generally equipped with relays and a small starting battery for automatic starting and stopping when equipment is turned on and off. In order to eliminate the high battery cost of the battery plant and the continuous running of the non-battery plant the semi-automatic plant has been developed. This is a battery plant equipped with relays for starting and stopping the engine when the load on the battery reaches certain limits. The light loads are supplied by the small capacity battery and the heavy loads are supplied directly from the generator. There is a little difference in the total cost of power supplied by the two types of plants except in individual cases. The high battery depreciation of the battery plant is balanced by the high unit fuel consumption of the non-battery plant at light loads. Where the plant is to be used most of the time at near full load the total cost of energy per kilowatt-hour will be the lower for the non-battery type, but where the load most of the time is small the battery plant will generally supply energy at the lower cost per kilowatt-hour.

Records were kept for a year on a 32 volt 800 watt battery plant at Mr. Odor's, the connected load of which was 2.7 kilowatts. It was a comparatively new installation and was completely overhauled at the beginning of the year. The equipment used in addition to lights consisted of washing machine, cream separator, vacuum cleaner, toaster, flat iron, and radio. The complete monthly record of the plant is given under the farm. In the following summary is given the energy supplied, the fuel and oil consumed, and the itemized cost of energy per year, month, and kilowatt-hour.

Record for the Year

Kilowatt-hours supplied	268.
Gallons of gasoline consumed	164.5
Gallons of oil consumed	2.5

Depreciation on $275 plant at 10% (10 year life)	$27.50
Depreciation on $125 battery at 20% (5 year life)	25.00
Interest and taxes on average investment at 8% ($400/2 value)	16.00
Total fixed charge	$68.50
Gasoline cost	14.80
Oil cost	1.95
Repair cost	5.00
Total cost per year of operation	$90.25

Monthly Average

Kilowatt-hours supplied	22.3
Gallons of gasoline consumed	13.7
Gallons of oil consumed	0.21
Interest, tax and depreciation cost	$5.71
Gasoline, oil and repair cost	1.81
Total cost per month of operation	$7.52

Consumption per Kilowatt-hour

Gallons of gasoline	0.61
Gallons of oil	0.0093

Cost per Kilowatt-hour

Gasoline	5.52¢
Oil	.73
Repair	1.87
Total operating cost	8.12¢
Interest, taxes, and depreciation	25.56
Total cost per kilowatt-hour supplied	33.68¢

The cost of gasoline, oil, and repairs represents the actual expense paid out for these items, the unit cost of which varied throughout the year. The interest, taxes and depreciation charge was computed on the cost of the plant and the estimated cost of the battery. The life of the plant was estimated from the results of a survey of plants discarded in Nebraska, the average life of which was 9.9 years.[1] The life of the battery was estimated from results of surveys in Nebraska and Missouri. The average life of batteries discarded in Missouri was 5.2 years[2] and the life in Nebraska for 80 ampere hour batteries was 5.06 years.[1] Similar data from Kansas give an average life of 6 years.[3]

The greatest item of expense in operating the individual plant was the fixed charge. Slightly over 80 per cent of the 33.68 cents per kilowatt-hour cost was due to interest, taxes, and depreciation. Since this item does not vary directly with the use, the unit cost of power will be materially lower where a larger amount of energy is used. Results from Illinois[4] show the cost of energy per kilowatt-hour to be 64 cents where the average use is 10 kilowatt-hours per month and 19 cents where the average use is 100 kilowatt-hours. The fuel and lubricant consumption per kilowatt-hour was 0.432 gallon of kerosene and 0.0245 gallons of oil.

The fuel and oil consumption of the individual plant will depend upon the type, the condition of the plant, and the per cent load at which it is operated. The consumption of the 0.61 gallons gasoline represents a fair value that may be expected from the individual plant as it is generally operated on the farm. Results from Missouri[2] show a gasoline consumption of 0.54 gallons per kilowatt-hour for a battery plant where an average of 20 kilowatt-hours was used per month. Records kept in Nebraska[1] give a fuel consumption per kilowatt-hour of 0.838 gallons for a battery plant, 0.66 and 0.63 gallons in successive periods for an automatic plant and 0.56 gallons for a semi-automatic plant. Recent information from Kansas[3] on the operation of three battery type plants, two of which were semi-automatic, is summarized in the following table:

Plant	Average kw-hr. used per month	Gallons gasoline per kw-hr.	Gallons oil per kw-hr.	Total energy cost per kw-hr.
A	57.90	0.46	0.0034	21.6¢
B	8.84	0.74	0.0188	99.7¢
C	53.17	0.37	0.0073	23.7¢

[1] University of Nebraska Bulletin No. 235.
[2] University of Missouri, Agricultural Experiment Station Bulletin No. 243.
[3] Kansas State College, Engineering Experiment Station Bulletin No. 30.
[4] University of Illinois, Agricultural Experiment Station Bulletin No. 332.

CONCLUSION

Electricity supplies both a service and a source of power. The amount expended by the urban residence for the few kilowatt-hours used represents a charge for service rather than a charge for power. The farm home is entitled to the same service as the city home, and many of them are securing it, but unfortunately the cost of service for the farm is higher than for the city. The same electric line, transformers, and equipment that supplies service often to no more than three farms in a mile may supply service to 175 city residences. Because of this low farm density, one farmer must pay the corresponding service cost of a number of city homes, consequently many farm homes cannot afford the advantages of electric service.

The expense of electricity in addition to the charge for service represents only the cost of energy which is comparatively low. In the utilization of energy above the few kilowatt-hours required for the service of lights and small appliances lies the solution of low cost electric service for the farm home. If the energy consumption of a farm approaches that of several city residences then the average cost per kilowatt-hour will be as low or lower than that in the city, and the farmer may have the advantage of electric service enjoyed by the city home at no greater cost. Throughout this report it may be noticed that the farms using the largest amount of electricity are the ones that are obtaining it at the lowest unit cost.

The use of electric energy above that required for home service must be on a sound economic basis, it must compete with other sources of power and save the farmer valuable time and money in the business of farming. Electricity is doing this on a large number of farms because of its adaptability to the operation of small power units and to automatic control. The operating costs of electric applications under actual farm conditions are given in this report in order that the farmer may decide to his own satisfaction wherein electricity will save him time and money. If, by its use, electric power will reduce the expense of farming, then the conveniences of electric service in the home will be available to many farmers who cannot otherwise afford them.