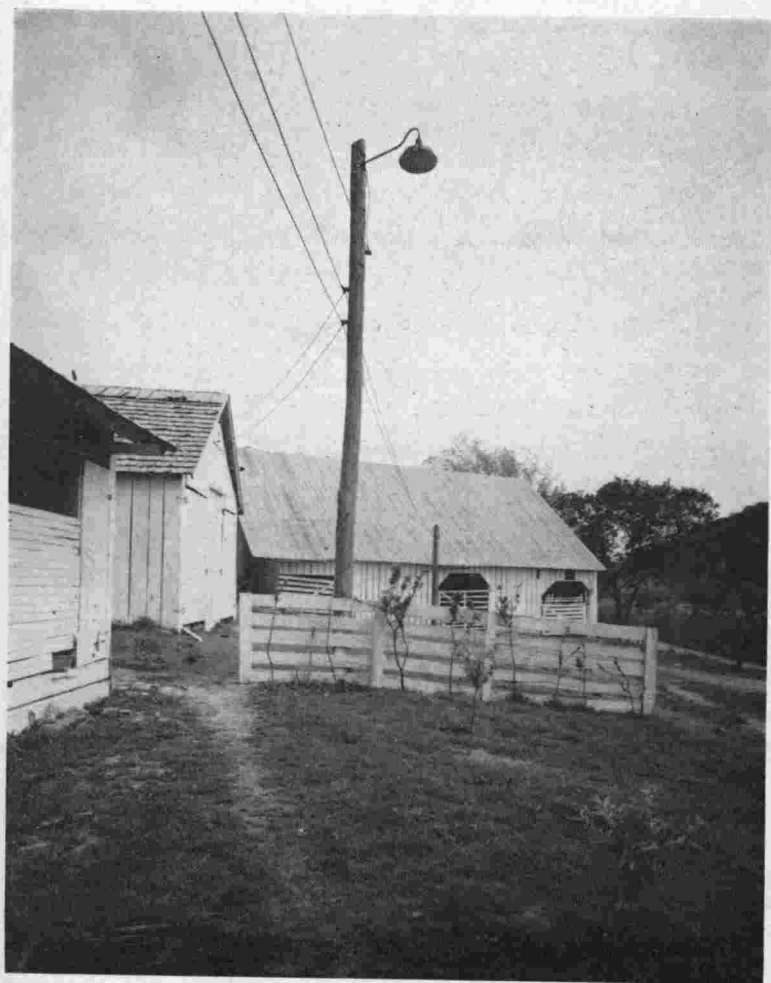


ELECTRICITY ON FARMS AND IN RURAL HOMES IN THE EAST TENNESSEE VALLEY

by

Howard J. Bonser and Joe F. Davis



Agricultural Experiment Station
University of Tennessee
Cooperating with
Bureau of Agricultural Economics
United States Department of Agriculture

FOREWORD

This study was made cooperatively by the Tennessee Agricultural Experiment Station and the Bureau of Agricultural Economics, United States Department of Agriculture. It is one segment of a broad investigation of some economic aspects of farm electrification. At this time (April, 1951) comparable studies have been begun in the state of Georgia, Iowa, Kansas, Mississippi, North Dakota, Washington, and Wisconsin. Each of these is being made as a joint effort of the interested state agricultural experiment station and the Bureau of Agricultural Economics. The studies are designed to develop information useful to the suppliers of electricity in rural areas and to the farmers who use it in their homes and on their farms. The work is financed in part by funds appropriated under authorization of the Research and Marketing Act. The Tennessee Valley Authority financed costs of mechanical tabulations for this study made in the East Tennessee Valley of Tennessee.

A great many people made valuable contributions in the conduct of this study. Special credit is due C. E. Allred, E. J. Long, and W. C. Wheeler, University of Tennessee; to M. R. Cooper and S. W. Atkins, Bureau of Agricultural Economics; to the several persons of the R. E. A. and TVA; for their consultation, to fellow staff members who gave valuable technical advice and assistance; to enumerators who interviewed the farmers; to the suppliers of electricity who furnished the data on consumption; and to the rural families who supplied the information on their use of electricity.

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ELECTRICITY ON FARMS AND IN RURAL HOMES IN THE EAST TENNESSEE VALLEY

Howard J. Bonser and Joe F. Davis¹

PART I. INTRODUCTION

THE SITUATION

Electric light and power is helping to bring conveniences, comforts, and labor saving devices to rural people. To many rural families electricity is a newcomer the potentialities of which are not yet fully realized.

Distribution of electric energy is by central systems, each of which supplies electric power to consumers within a given area. In this state distribution systems are almost entirely owned by municipalities or owned cooperatively by the consumers.

This study is directed toward three principal objectives: (1) to inquire into what uses farmers are making of electricity; (2) to determine as nearly as possible the consumption of power to be expected in a rural area; and (3) to appraise the impact of electricity on farm organization and operation.

It is believed that data presented here will assist suppliers of electricity in improving service in rural areas and will help farmers to make more efficient use of this form of power.

Scope and Method.—The study area is the East Tennessee Valley of Tennessee. Included in this Valley are the General Farming Area of East Tennessee and the General, Cotton and Dairy Areas of Lower East Tennessee.² Sampling areas or segments were drawn at random in 9 counties representing 8 sub-areas of the Valley.

Schedules were taken for all homes that were situated within the sampling segments and that were connected to power lines before January 1, 1948. Homes within the segments and not more than one-fourth mile from a distribution line and without the service also were visited and information was obtained as to why the homes did not have the service. No data were obtained from homes where electrification took place after January 1, 1948. In all, usable records were obtained from 492 farms and 79 non-farm

¹Associate Agricultural Economist, Tennessee Agricultural Experiment Station and Agricultural Economist, Bureau of Agricultural Economics, respectively.

²Type of farming areas 14 and 13. See Tennessee Agricultural Experiment Station Bulletin No. 169.

homes in rural areas. This report deals with the information secured from these 571 respondents.

Distributors furnished information on consumption of electricity and on costs for these respondents for a ten-year period ending December 31, 1948, or for the portion of the period in which the farm was electrified and records were available.

Records were not available in some cases due largely to one of two factors: (1) the families had moved to another route or out of the community and their records had been destroyed; (2) or meters were registered in some other person's name and could not be identified. Fifty-seven schedules were discarded for lack of data on consumption or other incompleteness.

Description of the Area.—The East Tennessee Valley is a series of valleys and ridges running in a northeast-southwesterly direction. It lies in the eastern part of the state between the Great Smoky Mountains and the Cumberland Plateau. It is about 55 miles wide at the north and 34 miles at the south. The distance between Chattanooga in the southwest to Bristol in the northeast is somewhat more than 200 miles (fig.1).

Soils range from very fertile limestone loams in the valleys to relatively infertile, cherty, and often shaly ridges and knobs. Most of the soils are derived from impure limestone and shale, but some are derived from highgrade limestone and sandstone.

Normal rainfall is about 50 inches annually. Length of growing season ranges from over 200 days at Chattanooga to 180 days at Bristol. Climate is favorable for the production of general farm crops such as corn, hay, small grains, and tobacco. In the Southern part, length of growing season is also favorable for production of cotton.

A general type of farming prevails, with farms tending to be small. Many farmers work off the farm a considerable part of the time. Corn and hay grown for feed and food are the major crops representing three-fourths of the harvested cropland. Tobacco is an important cash crop over most of the area. Cotton is important in the Southern part. Dairying is an important and growing enterprise throughout the Valley. Milk cows increased from 69,000 to 121,000 during the 20-year period 1925-1945 in 18 counties.³ Production of milk for the same period rose from 30,000,000 to 50,000,000 gallons a year.

Except for a few scattered neighborhoods of colored people, the population is composed mostly of descendants of English settlers who migrated here during the early days of our Republic. The total population has grown steadily due to natural increase. Since 1900 the number of farm people (though fluctuating) has changed little; urban population has quadrupled; and in recent years there has been some increase in the number of non-farm people in rural areas. There are two cities of over 100,000 population in the area

³Anderson, Bradley, Claiborne, Grainger, Greene, Hamblen, Hamilton, Hancock, Hawkins, Jefferson, Knox, Loudon, McMinn, Meigs, Roane, Sullivan, Union, and Washington.

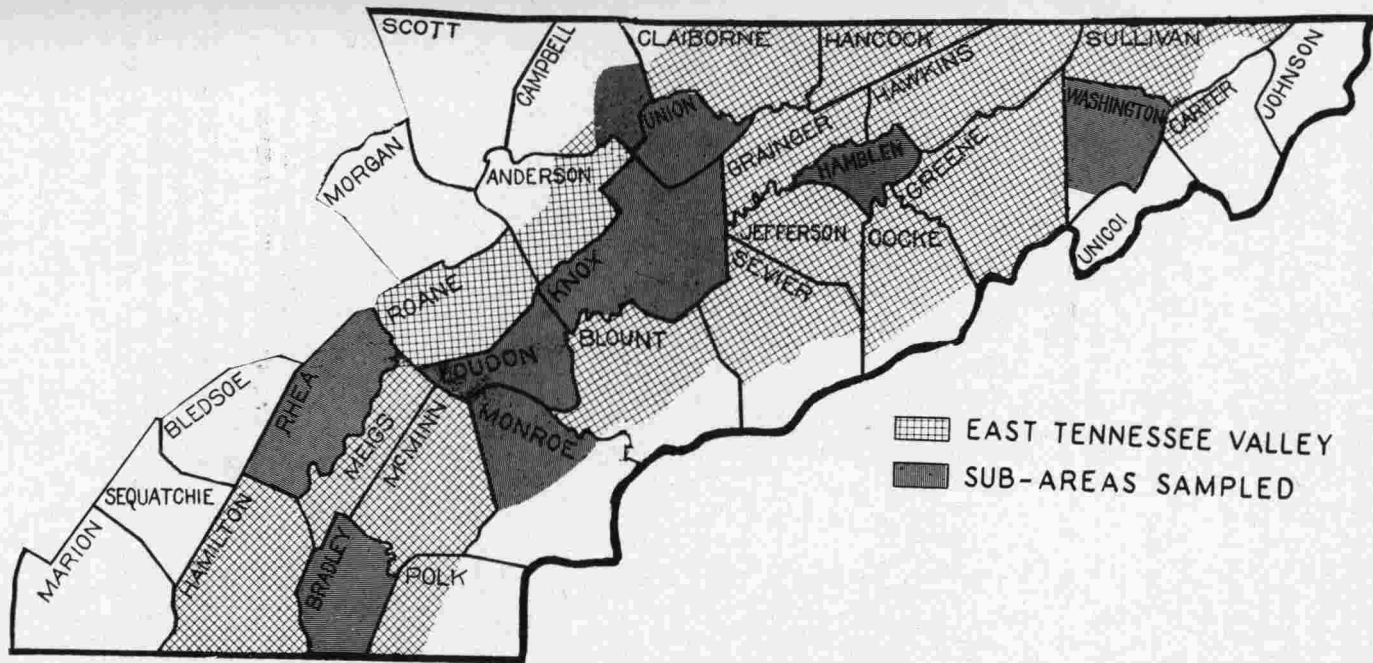


Figure 1.—Map of East Tennessee showing the Valley Area and Sub-Areas Sampled.

(Chattanooga and Knoxville) as well as a number of smaller cities and towns.

The Sample.—Of 571 usable schedules 492 were classified as farm and 79 as non-farm (table 1). A farm was defined as having

Table 1—*Acreage, Size of Dwelling, Livestock, and Tenure, 492 Farms and 79 Rural Non-farm Residences, East Tennessee, 1949*

Item	Farms or residences reporting		Average per farm or non-farm rural residence	
	Number	Percent	Reporting Acres	All farms or residences Acres
Farms				
Acreage				
Cropland	399	81	35.8	29.1
Operated	492	100	62.7	62.7
			Number	Number
Dwellings electrified	492	100	1.1	1.1
Rooms per electrified dwelling	492	100	5.5	5.5
Livestock-animal units ¹	457	93	11.3	10.5
Operated by owners ²	434	88	-----	-----
Rural Non-farm Residences				
Dwellings electrified	79	100	1.0	1.0
Rooms per electrified dwelling	79	100	4.6	4.6
Livestock-animal units ¹	8	10	1.2	0.1
Operated by owners ²	53	67	-----	-----

¹Tracts reporting 0.5 or more animal units.

²Includes landlords, full owners, part owners, and managers.

three or more acres of land with some agricultural production, or less than 3 acres of land if the value of agricultural products grown were valued at \$250 or more. Electricity was supplied by municipal systems for 333 of the farms and for 52 of the non-farm residences. Cooperative distribution systems supplied the remaining 159 farms and 27 rural residences. All distributors retailed power supplied by the Tennessee Valley Authority (TVA).

Farms averaged 62.7 acres of which 29.1 were in cropland, and 19.4 in open pasture. The remaining land was in woods and in other land such as brush, farmsteads, roads, and streams. Hay, the largest crop in terms of acreage, occupied 40 percent of the cropland. Corn, the next largest, occupied 20 percent. Small grains were also grown, oats alone occupied 10 percent of the cropland area. Tobacco and cotton, though occupying small acreages, were important cash crops in areas where grown.

On 93 farms no crops were reported other than possibly a garden. Eighty-four of these were part-time farms, most of which had a garden and/or cow. On 35 farms there were either no livestock, or less than 0.5 animal units. Farms averaged 10.5 animal units

of all kinds per farm; 3.8 of these were milk cows.⁴ Milk cows were on 78 percent of the farms. Twelve percent of the farms were operated by tenants (including croppers).

Considerable variation in the farming enterprises carried on existed among the farms. Of the 492 farms, 240 were classified as part-time, 114 as cash crop, 63 dairy, 8 poultry, 21 general livestock (cattle and/or hog), 28 general and 18 small general or self-sufficing (table 2).⁵ The general livestock, dairy, and poultry farms were

Table 2—*Acreage and Livestock Per Farm by Type of Farm, 492 Farms, East Tennessee, 1949.*

Type of farm	Farms	Average per farm		
		Acreage		Animal
		Total	Cropland	Units
	Number	Acres	Acres	Number
Part-time	240	28	9	3.3
Cash crop	114	83	47	9.8
Dairy	63	113	60	26.4
Poultry	8	106	60	22.9
Livestock	21	145	43	38.3
Small general	18	41	14	3.9
General	28	104	47	18.8
All farms	492	63	29	10.5

the largest in terms of acres operated and amount of livestock kept. For example, more than half of the reported livestock on all farms were on the 92 farms comprising these three types.

Both the general and the cash crop farms averaged 47 acres in crops. General farms, however, had 18.8 animal units per farm which was about twice the number reported for the cash crop farms. Those 18 farms where the value of farm products consumed at home was greater than that of farm products sold (small general) averaged 41 acres each with 14 acres used for crops and 3.9 animal units per farm. Part-time farms were smallest; they averaged 9 acres of cropland and 3.3 animal units per farm.

The small average size for all farms was due largely to a high proportion of part-time farms (49 percent).

⁴An animal unit is the equivalent of a mature horse or cow in terms of feed consumed and manure returned. Conversion factors were as follows:

Kind	Animal Units	Kind	Animal Units
Horse	1.0	Beef cow	.8
Milk cows	1.0	Other cattle & calves	.45
Milk heifer	.4	Pigs raised	.2
Sheep	.17	Hens & pullets	.013
Chicks raised	.004	Turkeys	.02

⁵See page 16 for definition of type.

PART II. ELECTRICITY ON FARMS

WIRING AND APPLIANCES

Extent of Wiring Done.—A total of 587 dwellings were reported on the 492 farms surveyed. Of this number 537 were wired for electricity. Houses with electricity averaged 5.4 rooms per dwelling, practically all of which were wired. In the electrified homes,⁶ only 25 rooms were not wired.

For these farms as a whole an average of four buildings were reported per farm; a dwelling (plus an occasional tenant house) and about three service buildings (table 3). General barns were

Table 3—*Number of Buildings and Percentage Wired for Electricity, by Type of Building, 492 Farms, East Tennessee, 1949.*

Type of building	Buildings			
	Farms	Per 100 farms		
		Total	Percentage wired	
	Number	Number	Number	Percent
Operator's dwelling	492	494	100	100.0
Other dwellings	34	93	19	46.8
Smoke house	121	121	25	25.6
General barn	402	452	92	29.2
Tobacco barn	11	18	4	11.1
Dairy barn	33	35	7	88.6
Milk house	28	29	6	79.3
Poultry laying house	241	257	52	22.2
Poultry brooder house	51	52	11	59.6
Hog house	28	29	6	0
Garage	127	131	27	32.1
Implement shed	48	50	10	18.0
Shop	35	35	7	62.8
Crib	83	89	18	10.1
Feed storage	24	24	5	33.3
Other buildings	80	82	17	57.3
All buildings	492	1991	4	49.3

on nine-tenths of the farms, poultry laying houses on one-half, and garages and smoke houses on one-fourth. Temporary structures were not enumerated.

Approximately one-third of the service buildings were wired for electricity. Of these buildings, dairy barns, milk houses, farm shops, and brooder houses were most likely to be wired. Little need was expressed for electricity in buildings that were not wired. Of 855 replies as to why buildings were not wired, 564 were to the effect that lights were not needed in them.

Forty-eight of the farms reported yard lights in the service areas.

Costs of Wiring.—Data as to wiring costs were incomplete for many farms because the farms had been wired before the present occupants came on them. For some farms the wiring was done at various times, and costs for only part of the total were known. However, complete costs were reported for 277 farms. For these the

⁶Rooms were enumerated if they were partitioned off from floor to ceiling and were used for living purposes. Baths, closet, attics, or large hallways used only as passageways or storage were not counted as rooms.

total wiring costs averaged \$83.40 per farm plus 3.5 hours of unpaid labor by the owner or someone in his family (table 4). Of the

Table 4—Average Cash Cost and Hours of Farm Labor Per Farm in Wiring Farm Buildings, 277 Farms, East Tennessee.¹

Item	Cost per farm
	Dollars
Cash Costs	
Home wiring	
Initial	72.34
Subsequent	5.64
Other wiring	
Initial	4.89
Subsequent	.53
Total	83.40
Labor contributed for which no pay was charged	3.5 (Hours)

¹Complete data not available for 215 cases.

total wiring costs \$78.08 was for house wiring, the remainder being for other buildings or lines on the farm. It should be borne in mind, however, that no buildings other than the dwellings were wired on many farms, and that much of the wiring was done when costs were lower than those now prevailing. Furthermore, electricity was used in the home for only 53 percent of the farms.

Electrical Equipment.—Household use: Inquiry was made as to the electrical equipment of all kinds in homes of the farm operators and those of other farm residents. This equipment was grouped into two classes on the basis of amount of electric energy used. Equipment expected to use 360 or more kilowatt-hours per year at

Table 5—Electrical Equipment Reported in Farm Homes, 492 Farms, East Tennessee, 1949.

Equipment	Farms reporting equipment	Pieces of equipment per 100 farms	Equipment	Farms reporting equipment	Pieces of equipment per 100 farms
	Percent	Number		Percent	Number
Heavy users of					
Electricity			Food mixer	8.5	9.1
Refrigerator	78.9	83.1	Sewing machine	5.3	5.3
Range	32.1	33.1	Razor	5.1	5.3
Water heater			Water heater		
(pressure)	16.3	17.5	(immerision)	4.3	4.5
Freezer	4.5	4.5	Broiler	2.6	2.6
Roaster	3.3	3.3	Ironer	1.8	1.8
Air Conditioning	.4	.4	Record player	1.4	1.4
Light users of			Coal Stoker	1.2	1.2
Electricity			Hot air fan	1.2	1.2
Iron	97.6	107.5	Blanket	1.0	1.0
Radio	94.5	114.2	Milk pasteurizer	.8	1.0
Washing machine	77.6	82.3	Attic exhaust fan	.6	.6
Hot plate	40.9	42.7	Kitchen exhaust fan	.4	.4
Household fan	30.5	34.1	Window vent fan	.4	.4
Churn	28.9	29.5	Meat grinder	.4	.4
Clock	25.4	27.8	Dishwasher	.2	.2
Vacuum cleaner	25.0	25.6	Oil furnace	.2	.2
Toaster	23.0	24.4	Clothes drier	.2	.2
Percolator	17.7	18.1	Other	2.4	2.6
Heating pad	14.6	16.5			
Space heater	14.2	18.3	Total	100.0	733.5
Waffle iron	10.6	10.8			

normal operation on the farms was listed as a "heavy" user, and equipment consuming less than that as a "light" user (table 5). Heavy users included refrigerators, ranges, water heaters, freezers, roasters, and air conditioning units. There were 83 refrigerators per 100 farms, 33 electric ranges, and 17.5 water heaters (pressure type). Two of the homes were equipped with air conditioning units.

Household equipment using less than 360 kilowatt-hours of electricity a year under normal use was more numerous than the heavy users. Electric irons were on 97.6 percent of the farms, averaging 107.5 irons per 100 farms. There were 114.2 radios and 82.3 washing machines per 100 farms. None of the other "light" users of electricity were on as many as half of the farms. There were between 25 and 50 of the following per 100 farms: hot plates, household fans, churns, clocks, and vacuum cleaners. Those between 10 and 25 per 100 farms were toasters, percolators, heating pads, space heaters, and waffle irons. Other pieces of equipment reported were all in concentrations of less than 10 per 100 farms.

Electrically operated household equipment of all kinds averaged slightly more than 7 items per farm.

Livestock production: Electricity was not widely used in livestock production except on farms with large herds or flocks. Twenty-six farms had milking machines, and most of them had more than 10 milk cows. Twenty of the 22 farms with more than 15 milk cows had milking machines; 21 had milk coolers. Only 39 farms had herds of more than 10 milk cows.

There were 24.0 electric chick brooders per 100 farms (table 6). These were most numerous on farms brooding 75 or more chicks.

Table 6—*Electrical Equipment and Lights Used in Caring for Livestock, 492 Farms, East Tennessee, 1949.*

Equipment	Farms reporting equipment	Pieces of equipment per 100 farms	Equipment	Farms reporting equipment	Percent of equipment per 100 farms
	Percent	Number		Percent	Number
Dairy equipment			Other equipment		
Heavy users of electricity			Fence controller	7.9	8.7
Milking machine	5.5	6.3	Stock clipper	.8	1.0
Milk cooler	5.3	5.7	Ventilating fan	.2	.2
Water heater	4.7	5.1	Total		57.4
Light users of electricity			Lights		
Cream separator	1.0	1.0	Dairy	7.3	
Churn ¹	.6	.6	Poultry	2.6	
Radio	.2	.2	Other	6.1	
Poultry equipment					
Chick brooder-hover	15.8	24.0			
Chick brooder-battery	3.0	3.6			
Egg incubator	.4	.6			
Water warmer	.4	.4			

¹Butter churns for making butter in homes were enumerated under household equipment, see Table 5.

No chicks were brooded on a fifth of the farms. One-fourth of the

brooders were home-made, either using light bulbs or thermostatically controlled heating elements for heat. Incubators were reported on two farms. Only one was used during the year. Water warmers for poultry were reported in two farms.

Fence controllers were reported on 7.9 percent of the farms. About one-half of these were activated by batteries. The remainder were connected to power lines. Stock clippers were on less than one percent of the farms.

Lights were reported used in dairy production on 7.3 percent of the farms, for poultry (night lights to lengthen the hen's working day) 2.6 percent, and for other livestock 6.1 percent.⁷

Farm shop: Farm shops were reported on 35 of the 492 farms. Electricity was used to a limited extent in farm shops. Only 27 pieces of electrically operated farm shop equipment were reported per 100 farms. Tool grinders were most frequently reported (table 7). Bench saws, including motor driven circular and band saws for shop use were on 3.4 percent of the farms. Other wood and metal-working tools powered by electricity were reported occasionally.

Table 7—Number of Electrically Operated Shop Tools by Kind, 492 Farms, East Tennessee, 1949.

Kind	Farms reporting equipment	Pieces of equipment per 100 farms		Kind	Farms reporting equipment	Pieces of equipment per 100 farms	
		Percent	Number			Percent	Number
Tool grinder	8.5		8.7	Air Compressor	.8		.8
Saw (bench including electric band)	3.4		3.9	Sander	.8		.8
Portable drill	2.6		2.6	Planer	.6		.6
Soldering iron	2.4		2.8	Battery charger	.6		.6
Drill press	1.4		1.4	Jig saw	.4		.4
Jointer	1.2		1.2	Concrete mixer	.4		.4
Lathe	.8		1.0	Paint sprayer	.4		.4
				Other ¹	1.2		1.2
				Total			26.8

¹Includes one each of the following: edger, flexible shaft, forge, portable saw, shaper and welder.

Other farm equipment: In addition to appliances previously mentioned two wood cut-off saws, two seed cleaners, and two corn shellers were reported powered by electric motors. None of the motors was larger than one horsepower.

Water Systems.—Electricity was used to pump water for 166 farm water systems (165 pressure-type systems and one with a raised reservoir). Approximately one-third of the electric pump motors were $\frac{1}{2}$ -horsepower, another third were smaller, and the remainder were larger than $\frac{1}{2}$ -horsepower. An additional 22 farm water systems were reported in which miscellaneous means were used to fill the pressure tank or the reservoir—gravity, ram, water-wheel, and gasoline engine. Only one of these was a pressure tank system (table 8).

An additional 22 farms used city water, and 10 had water piped from adjoining farms.

A total of 220 systems with running water were reported; 160

⁷This does not necessarily agree with the number of buildings reported wired in Table 1 inasmuch as some buildings may have been wired but not used.

supplied both families and livestock; 54 supplied families only; and 6 served livestock only (table 9). Bathrooms were reported on 84 farms. Sixty-one stock tanks were reported with running water, as were 29 general barns, 14 dairy barns, and 10 laying houses (Table 10). A disproportionate number of these were on farms that had

Table 8—Number of Farm Water Systems with Running Water, on 173 Farms, by Source of Power, East Tennessee, 1949.

System	Horsepower of Electric Motors							Other power	Total
	¼	1/3	½	¾	1	Be- tween 1 & 2	2 and up		
Pressure system	40	16	58	13	12	3	7	16	166
Reservoir gravity	1							21 ²	22
Total	41	16	58	13	12	3	7	16	188

¹Gasoline engine.

²Includes 5 rams, 1 water wheel, and 15 cases where water flows into reservoir by gravity.

Table 9—Water Systems and Use of Water on 205 Farms with Running Water, East Tennessee, 1949.¹

Type of system and use of water	System Number
Type	
Farm System	
Pressure tank	166
Raised reservoir	22
Total	188
Other System	
City water	22
From adjoining farm or home	10
Total	32
Use of Water	
Family use only	54
Livestock only	6
Family and livestock	160
Total	220

¹Some farms had more than one system. Farms without running water numbered 287.

Table 10—Number of Farm Buildings with Running Water and as a Percentage of All Farm Buildings by Type of Building, 492 Farms, East Tennessee, 1949.

Type	Buildings or stock tanks with running water	
	Number	Percentage of all farm buildings
		Percent
Dwellings	215	36.6
Barns		
General	29	6.4
Dairy	14	40.0
Houses		
Milk	13	44.8
Laying	10	3.9
Brooder	1	1.9
Other buildings	10	1

¹Percent is not shown since no water is used for many of such buildings.

electric service for more than 5 years.

Farmers without running water used rope and buckets or hand pumps to draw water from wells or cisterns. Two had engines on pump jacks. They also used open springs, creeks, and ponds. Many farmers with running water used ponds or creeks to water livestock.

Running water was made available for the first time through electrification on nearly all farms where it was found. Only 13 farmers reported having had running water previously. Most of them used gasoline engines for pumping.

Approximately three-fifths of the farm systems were installed since World War II (1945 and later). Water systems were proportionately most numerous on owner operated farms, on livestock farms, on large farms, and on farms with highest incomes.

CONSUMPTION OF ELECTRICITY ON SAMPLE FARMS

Electricity Used, 1948.—The amount of electricity consumed during the calendar year 1948 varied quite widely among farms in this sample. One small part-time farm that had been wired in the fall of 1947 used only 63 kilowatt-hours of electricity during 1948. For no month was the minimum of 25 kilowatt-hours reached on this farm. At the other extreme was a 150-cow dairy farm with a total of 10 wired dwellings, milking machines, milk coolers, water heaters, freezers, portable motors, and other electrical equipment, resulting in a total consumption of 56,406 kilowatt-hours during the year. Twelve farms used more than 12,000 kilowatt-hours during the year; 15 farms used less than 250. The average of all farms was 2,139 kilowatt-hours (fig. 2.) However, this average was strongly influenced by a few high consuming farms. More than half of the farms used less than 1,000 kilowatt-hours each during the year.

Seasonal Consumption.—With the varied uses for electricity on these farms there appears to have been no pronounced seasonal pattern of consumption for the group as a whole, although there were some small differences between months. In 1940 and in 1948 an average of about 20 more kilowatt-hours were consumed per month during the last six months of the year than during the first six months. This condition, however, was not true in 1947 (fig. 3).

Furthermore, consumption in June 1947 averaged 200 kilowatt-hours; 32 more than May and 23 more than July. This was accounted for almost entirely by one of the large poultry farms which used about 10,000 more kilowatt-hours in June than in any other month.

Trend in Consumption of Electricity.—The average annual consumption in 1939 for the 31 farms for which records were available was 654 kilowatt-hours (table 11).

In 1948 the average consumption for all farms in the sample was 2,139 kilowatt-hours. The annual increase was at a fairly constant rate averaging 177 kilowatt-hours.⁸ Average consumption in 1948

⁸A straight line trend computed by the least squares method $Y = 564 + 177X$; 1939=0. Y is the calculated kilowatt-hours and X is the number of years after 1939.

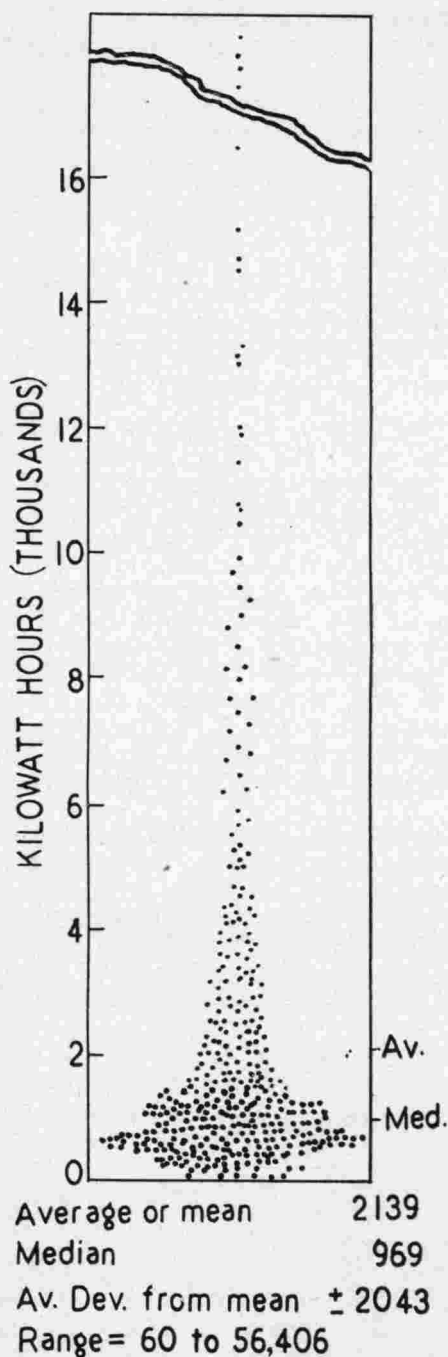


Figure 2.—Farms by Consumption of Electricity.
492 farms, East Tennessee, 1941.

was slightly less than in 1947, due to a much greater proportion of farms using electricity for the first time.⁹

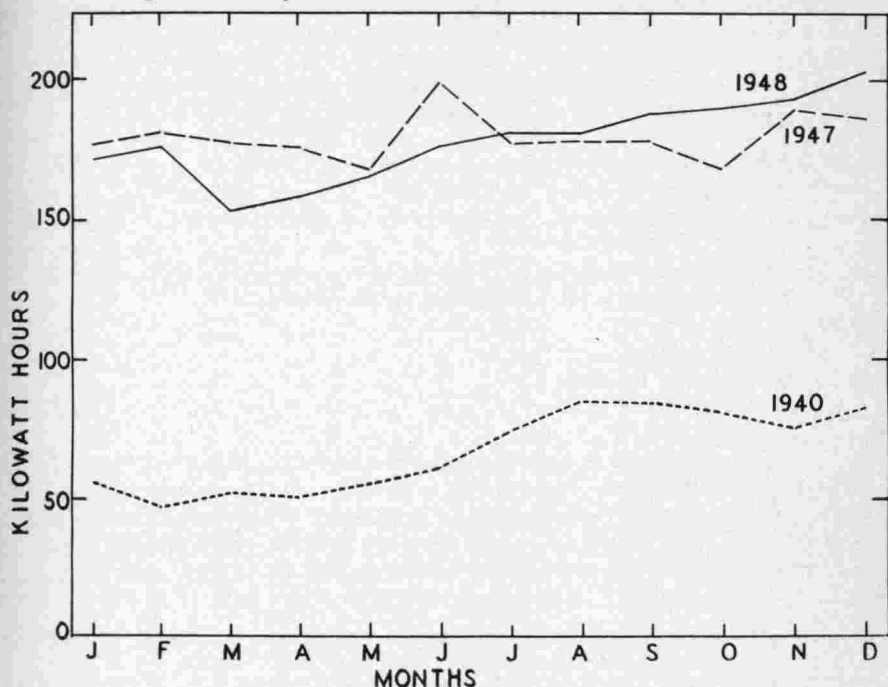


Figure 3.—Monthly Consumption of Electricity, 492 farms, East Tennessee, 1940, 1947, and 1948.

Table 11.—Average Consumption of Electricity 1939-1948, 492 Farms, East Tennessee.

Year	Farms reporting ¹	Consumption of elec- tricity per farm
	Number	Kilowatt-hours
1939	31	654
1940	46	765
1941	79	899
1942	141	1,038
1943	164	1,256
1944	174	1,375
1945	189	1,527
1946	240	1,783
1947	287	2,165
1948	492	2,139

¹Includes those for which consumption data were available.

FACTORS IN THE CONSUMPTION OF ELECTRICITY ON FARMS

Tenure.—Inasmuch as farm tenants move more frequently from farm to farm than do owners, and inasmuch as their material level of living is considered to be lower than that of farm owners it is desirable to check what relationships, if any, exist between

⁹Consumption in 1948 with the same proportion of newly electrified farms as was true in 1947 would have been 2,286 kilowatt hours.

farm tenure and consumption of electricity. In this study the standard classification of owner-operator, part-owner, and tenant was followed with one exception; owner-operators who rented out more land than they themselves operated were classified as landlords. Owners represented three-fourths of all operators. The numbers in all classifications were as follows:

Landlords	81
Owners:	
Owner-operators	288
Part-owner operators	52
Managers	2
Indefinite status, but owning some land	12
Tenants:	
Share tenants	27
Share cash tenants	4
Cash tenants	12
Croppers	14

Landlords farmed smaller places and supplemented their farm income with off-farm sources to a greater degree than did owners or tenants. A higher proportion of landlords were part-time farmers. They were also older. Among the landlord families over half of the men were 60 years or older (30 percent were 70 years and up). This was in contrast with one-fourth 60 years and over for owner-

Table 12—*Factors in Consumption of Electricity on Farms, by Tenure of Operator, 492 Farms, East Tennessee, 1948.*¹

Item	Unit	Tenure of Operator		
		Landlord	Owner	Tenant
Farms	Number	81	354	57
Acreage operated	Acres	46	71	57
Animal units	Number	6	11	8
Income				
Farm	Dollar	1175	2693	2929
Total	Do	3361	4414	3955
Houses wired per 100 farms	Number	102	111	105
Percentage of farms				
Part-time	Percent	77	47	21
Cash crop	Do	1	22	63
Livestock	Do	17	20	11
General and self-sufficing	Do	5	11	5
Farms using electricity in farming operation	Do	46	48	42
Electrical equipment per 100 farms				
Refrigerators	Number	84	88	50
Ranges	Do	44	33	19
Water heaters piped in home	Do	20	20	2
Iron	Do	104	109	102
Radio	Do	104	117	102
Home appliances, all kinds	Do	763	774	443
Milking machines	Do	2	7	8
Milk coolers	Do	2	6	7
Dairy water heaters	Do	3	5	9
Chick brooders	Do	22	32	5
Livestock equipment of all kinds	Do	36	60	30
Shop tools, total all electric	Do	26	27	28
Average consumption of electricity, 1948	KWH	1,980	2,861	1,358

¹For a complete listing of electrical equipment by tenure see appendix tables 9 to 12.

operators and one-sixth for tenants. Dairy cattle were as numerous on tenant farms as on owner farms. In terms of total acres the owner farms were largest (table 12).

Electrical equipment reflects the life cycles of families involved; for example, landlords, who were older and probably wealthier, had more electric ranges, water heaters, freezers, and other costly equipment in their homes. Owner-operators, who made more of their living directly from their farming operations, used more electrical equipment than landlords for livestock production. Tenant homes had fewer items of electrical equipment than either landlord or owner-operator homes.

There were also fewer chick brooders and fewer fence con-

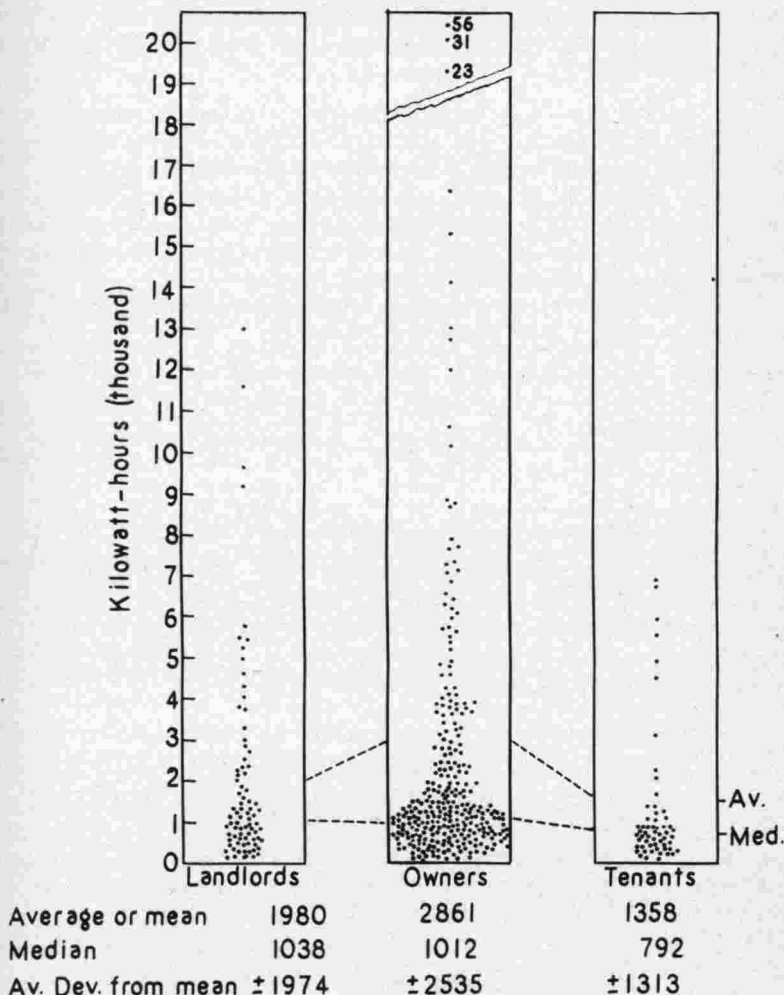


Figure 4.—Farms by Kilowatt-hour Consumption of Electricity for Landlords, owners, and Tenants, 492 farms, East Tennessee, 1948.

trollers on tenant farms. Milking machines, milk coolers, and dairy water heaters were as numerous on tenant as on owner farms. When found on tenant farms, however, they were (except for one cash renter) on share-cropper farms where the cropper received a share of the milk check for caring for the landlord's milk herd, hence the dairy equipment was owned by the landlords.

Kilowatt-hour consumption of electricity averaged 2,861 for the owner farms in 1948; 1,980 per farm for the landlords; and 1,358 average for the tenants. Individual cases varied greatly from these averages (fig. 4).

Tenure appears to be a factor in the use of farm electricity, but indirectly so, inasmuch as it is related to levels of living, income, and age of farm operator. The fewer pieces of electrical equipment in tenant homes was more pronounced than was true for equipment used in production.

Type of Farm.—The type of farm operated is generally considered to have a bearing on use of electricity. For example, dairy farms need to cool milk and to heat the water used in cleaning utensils, poultry farms have need of energy for brooders and in some cases for night lights in the laying house; while cash crop farms have less need for these items. For this reason the data were classified according to the types of farms found.

Originally farms were placed in seven classes or types based on source of income as is shown in table 13.

Table 13—Number of Farms by Type, 492 Farms, East Tennessee, 1948.

Source of income and type	Farms Number
Income from farm	
More than 50 percent of all income	
More than 50 percent from sales	
Cash crop	114
Dairy	63
Poultry	8
Livestock	21
Less than 50 percent from sales	
General	28
Self-sufficing	18
Total	252
Less than 50 percent of all income	
Part-time farm	240
Grand total	492

Not all of these groups had enough farms to lend stability to the averages, hence it was necessary to make some combinations. Dairy, poultry, and general livestock farms were combined into one livestock group for presentation of most data. Then the general and self-sufficing (or small general) were combined into a single general farming group. For convenience in presentation this group is referred to as the general farming group.

Livestock farms (dairy, poultry, and general livestock) were largest in size whether measured in terms of acres operated or

Table 14—*Factors in Consumption of Electricity on Farms, 492 Farms by Type, East Tennessee, 1948.*¹

Item	Unit	Type of farm			
		Part time	Cash crop	Live-stock	General and self-sufficing
Farms	Number	240	114	92	46
Acreage operated	Acre	28	83	120	80
Animal units	Number	3	9	28	12
Income					
Farm	Dollar	597	2878	6619	2763
Total	Do	3025	3455	8440	3567
Houses wired per 100 farms	Number	108	105	126	113
Percentage of farms					
0 milk cows	Percent	37	7	6	7
1 to 5 milk cows	Do	62	80	37	65
6 to 10 milk cows	Do	1	10	21	24
Over 10 milk cows	Do		3	36	4
Farms using electricity in farm operation	Do	37	43	72	57
Electrical equipment per 100 farms					
Refrigerators	Do	82	70	106	78
Ranges	Do	35	16	52	26
Water heaters piped in line	Do	16	5	33	24
Irons	Do	104	104	124	104
Radios	Do	112	104	130	124
Home appliances, all kinds	Do	608	571	1018	700
Milking machines	Do	0	2	32	0
Milk coolers	Do	0	1	29	0
Dairy water heaters	Do	0	1	26	0
Chick brooders	Do	14	18	76	22
Livestock equipment of all kinds	Do	22	30	196	35
Shop tools, total all electric	Do	24	11	42	51
Average consumption of electricity	KWH	1670	1233	4592	1925

¹For a complete listing of electrical equipment by type of farm see appendix tables 13 and 16.

numbers of livestock. They averaged 120 acres per farm. There were 126 electrified houses per 100 livestock farms, the highest of any type-of-farm group. Total income averaged \$8,440 per farm for livestock farms, \$3,567 for general and small general, \$3,455 for cash crop, and \$3,025 for part-time farms. However, as four-fifths of the incomes for part-time farmers came from off-farm sources it is likely that their expenses were less and hence their purchasing power was as great as those for farmers in the cash crop or the general farm groups.

Livestock farms, dairy, poultry, and general livestock, had more electric home appliances of nearly all kinds (table 14). Cash crop farms had fewest of any of these appliances. Data were not available as to why this should be true, but probably it is an association of livestock farming in this area with higher farm incomes, more mature families, and higher levels of living.

Items high in cost such as ironer, coal stoker, oil furnace, dishwasher, or clothes drier, while reported in only a few cases, were found almost exclusively on the livestock and part-time farms.

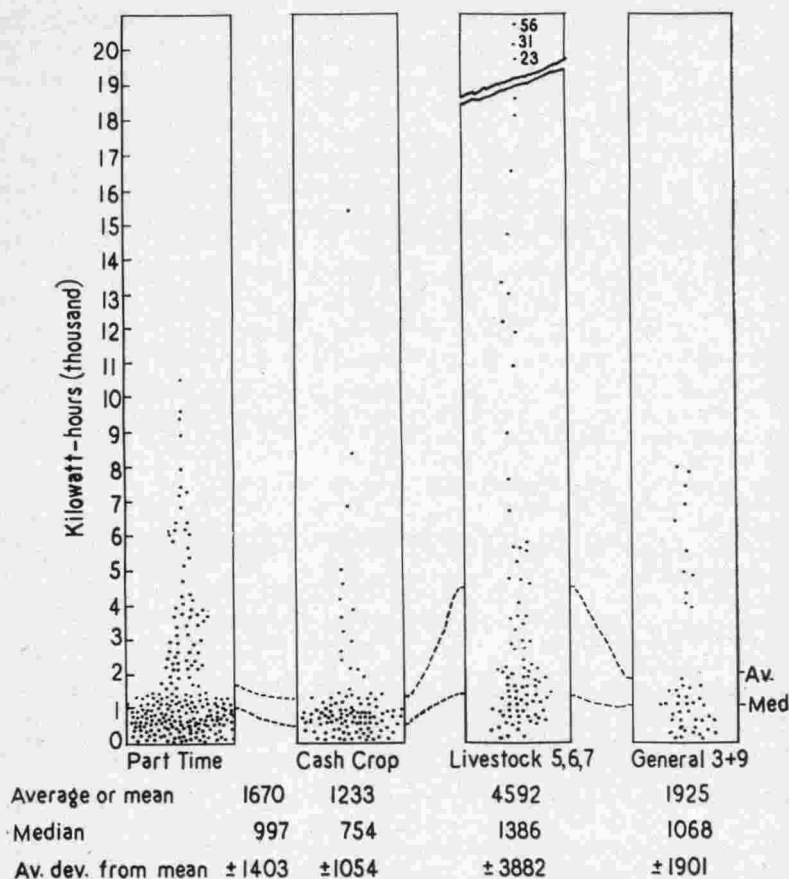


Figure 5.—Farms by Kilowatt-hour Consumption of Electricity and by Type, 492 farms, East Tennessee, 1948.

Seventy-two percent of the livestock farmers used electricity for both home and farm production purposes, while more than half of the part-time farmers and cash crop farmers used it in their homes only.

Milking machines, milk coolers, and dairy water heaters were found almost exclusively on livestock farms. Chick brooders were more widely diffused, but they were still three times as numerous on livestock farms as on any of the other type groups.

Shop tools using electricity were most numerous on the general farms.

Consumption of electricity during 1948 averaged 4,592 kilowatt-hours for the livestock farms. This was $2\frac{1}{2}$ times that for any other group. General farms were second in amount of electricity used with a 1,925 kilowatt-hour average for the group. Consumption on part-time farms averaged 1,670 kilowatt hours, and on cash-crop farms 1,233 (fig. 5).

Size of Farm.—To what extent size of farm is related to amount of electricity used is a problem of considerable importance. The number of acres operated was used as a measure of farm size in this study for several reasons: farm acreage is available in U. S. Census releases by the county; it is readily understood; and it is easy to compute. Furthermore, for farms of a given type and comparable soils, it is a reasonably accurate measure of size of farm business.

Both farm income and total income increased with farm size, as did the number of electrified houses per 100 farms. The percentage of part-time farms, however, decreased from 85 percent of the farms under 10 acres in size to 11 percent of farms of 180 acres and up (table 15).

Table 15—*Factors in Consumption of Electricity on Farms Grouped by Acres Operated, 492 Farms, East Tennessee, 1948.*¹

Item	Unit	Acres Operated					
		Under 10	10-29	30-49	50-99	100-179	180 & up
Farms	Number	117	98	72	101	67	37
Acreage operated	Acre	4	18	38	73	129	268
Animal units	Number	3	4	6	12	17	41
Income							
Farm	Dollar	635	995	1821	2470	4009	10442
Total	Do	2978	2958	3145	3767	5673	11756
Houses wired per 100 farms	Number	102	105	103	108	110	157
Percentage of farms							
Part-time	Percent	85	69	40	27	18	13
Cash crop	Do	7	17	34	32	34	29
Livestock	Do	4	7	18	26	31	53
General and self-sufficing	Do	4	7	8	15	17	5
Percentage of farmers							
Landlords	Do	26	15	13	14	12	16
Owners	Do	62	75	69	79	75	74
Tenants	Do	12	10	18	7	13	10
Farms using electricity in farm operations	Do	37	37	43	52	57	81
Electrical equipment per 100 farms							
Refrigerators	Number	84	74	72	86	82	119
Ranges	Do	32	42	24	28	28	54
Water heaters piped in line	Do	15	16	8	16	18	40
Iron	Do	103	105	101	104	115	135
Radio	Do	113	108	104	111	126	140
Home appliances all kinds	Do	689	687	618	734	762	1166
Milk machines	Do	0	0	1	6	10	46
Milk coolers	Do	0	0	1	5	9	43
Dairy water heaters	Do	0	0	1	4	9	38
Chick brooders	Do	9	19	18	28	21	138
Livestock equipment of all kinds	Do	12	31	33	58	61	313
Shop tools, total all electric	Do	20	13	43	23	34	54
Average consumption of electricity	KWH	1612	1829	1377	1837	2671	5975

¹For a complete listing of electrical equipment by acreage see appendix tables 17 to 20.

Electric equipment used in homes increased in numbers as farm size increased. However, a large part of the extra electrical equipment for household operations probably was a result of additional electrified homes occupied by farm labor families on large farms. For example, electric ranges would have been about as numerous in homes on small and medium sized farms as in those on large

farms if all electrified houses are considered.

Proportionately more of the large farms used electricity for production purposes. Milking machines, milk coolers, and dairy water heaters were almost exclusively on farms of 50 or more acres, with the greatest concentration on farms of 180 acres and up. There were 313 pieces of electrical appliances of all kinds used on livestock per 100 farms of 180 acres and up. Sixty-one per 100 farms was the highest on any of the other groups. With each increase in size of farm group there was an increase in number of electrical appliances used on livestock relative to number of farms.

Electricity used per farm averaged 1,612 kilowatt-hours in 1948 for the 117 farms under 10 acres in size, and 5,975 kilowatt-hours per farm for those farms of 180 acres or more. The lowest per farm use of electricity for any size group was for the farms of 30 to 49 acres. These averaged 1,377 kilowatt-hours in 1948. This group had relatively fewer home appliances than any other group. It is possible that farms in this group were of an uneconomic size, too large for part-time farming and too small for full-time farming operations.

Larger farms used more electricity than smaller ones in 1948 at an average rate of 20 kilowatt-hours for each acre increased in size of farms.¹⁰ However, individual farms varied widely in this respect. The close relationship between farm acreage and income ($r = +.650$) was probably responsible for the close relationship that existed between acres and kilowatt-hour consumption.¹¹

Income.—In the preceding sections the relationships of size and type of farm and the use of electricity were discussed. In this section attention is directed to income. It should be borne in mind, however, that the higher electric consumption resulted from a combination of conditions rather than from any one condition.

Income as used in this section refers to the gross return from the farm (including value of farm products used by the family) plus all other sources of income received such as wages, rents, government payments, etc. This is a gross figure before farm operating expenses and taxes are deducted. As such, it tends to reflect ability to spend and also size of business although it is not an accurate measure of either.

Of 37 kinds of electric appliances itemized, all but four were in greater concentration on farms of the high-income group. Those appliances requiring additional equipment to go with them increased greatly in number as incomes rose. An illustration is electric water heaters which require plumbing and were very few in number (only 7 per 100 farms) for farms of under \$1,500 income, but were 39 per 100 high income farms (table 16). Furthermore, such labor-saving machines as electric washers, vacuum cleaners, and food mixers were quite scarce on the low-income farms.

¹⁰A straight line regression compiled by the least squares method $Y = 839 + 19.6X$. Y is the calculated kilowatt-hours. X is the size of farm in acres. Standard error of estimate, the range which includes about two-thirds of the cases, was ± 3057 kilowatt-hours. Coefficient of correlation was $+ .501$.

¹¹Kilowatt-hours decreased slightly with acreage increase after the effect of income and year electrified was taken out by multiple correlation; see footnote 14, Page 25.

Table 16—*Factors in the Consumption of Electricity on Farms Grouped by Total Income, 492 Farms, East Tennessee, 1948.*¹

Item	Unit	Income Per Farm		
		Under \$1500	\$1500-\$4999	\$5000 and up
Farms	Number	56	329	107
Acreage operated	Acres	31	48	124
Animal units	Number			
Income				
Farm	Dollar	580	1415	6631
Total	Do	1053	2972	9565
Houses wired per 100 farms	Number	102	104	128
Percentage of farms				
Part-time	Percent	55	56	23
Cash crop	Do	16	26	19
Livestock	Do	9	11	46
General and self-sufficing	Do	20	7	12
Percentage of farms				
0 cows	Do	32	22	13
1-5 cows	Do	68	66	47
6-10 cows	Do	0	10	10
Over 10 cows	Do	0	2	80
Farms using electricity in farming operation	Do	30	42	71
Electrical equipment per 100 farms				
Refrigerators	Number	75	79	99
Ranges	Do	14	28	58
Water heaters piped in line	Do	7	12	39
Irons	Do	104	101	130
Radios	Do	102	108	143
Home appliances, all kinds	Do	544	650	1089
Milking machines	Do	0	2	24
Milk coolers	Do	0	2	21
Dairy water heaters	Do	0	1	21
Chick brooders	Do	14	16	72
Livestock equipment of all kinds	Do	16	29	166
Shop tools, total all electric	Do	20	18	60
Average consumption of electricity	KWH	1048	1404	4971

¹For a complete listing of electrical equipment of income see appendix tables 21 to 24.

It should be recalled, however, that the extra number of dwellings that were wired on high-income farms were partially responsible for the greater appliance density per farm. The farm laborer homes on these farms, however, were poorly equipped with electric appliances in contrast with those of the farm operator himself. As an illustration, electric washing machines and refrigerators were in only 40 percent of the farm laborer homes. Electric ranges were in 18 percent and electric water heaters in 10 percent.

Seventy-one percent of the high-income farmers used electricity for farm operation purposes as well as in their homes while 70 percent of the low-income farmers used it in their homes only. Electric equipment used in livestock production was in far greater density on high-income farms. Milking machines, milk coolers, and dairy water heaters were almost entirely found on farms of \$5,000 or more income, while the density of chick brooders was four times as great as on farms with smaller incomes. Shop tools, electrically operated, were three times as numerous on the high income farms.

Consumption of electric energy during the 1948 year averaged 1,048 kilowatt-hours per farm for the low-income farms; 1,404 for the medium-income farms; and 4,971 for those with high incomes. Apparently, income strongly influences consumption of electricity. Even after adjusting for the additional homes on high-income

farms, kilowatt-hour consumption averaged almost four times as great per home wired as for the low-income group and three times as great as for the medium-income group.

Use of electricity per farm in 1948 increased 553 kilowatt-hours per \$1,000 increase in income.¹² The coefficient of correlation was +.81, thus indicating a rather close relationship between the two.

Years Since First Connected.—Few farmers install all their electrical equipment at the time the buildings are first connected to a power line. It is more likely that a minimum of equipment is installed immediately and additional items are added either as desires for them arise or as finances permit. Consequently, consumption of electricity on a given farm ordinarily increases with experience.

In order to check this further the schedules were sorted into two groups of approximately equal numbers. One group of 238 had been wired five years or less. The other group of 254 had used electricity more than five years, that is they were connected in 1942 or before.

Electric equipment in homes, electric shop tools, and electrical equipment used in dairy and poultry production were more numerous on farms that were connected to distribution systems longest. This was especially true for the more expensive items, or those requiring complementary equipment; for example, water heaters.

Table 17—Factors in the Consumption of Electricity on Farms, 492 Farms Grouped by Year Electrified, East Tennessee, 1948.¹

Item	Unit	Year Electrified	
		1942 and before	1943 and after
Farms	Number	254	238
Acreage operated	Acre	69	56
Animal units	Number	12	8
Income			
Farm	Dollars	2946	1929
Total	Do	4890	3437
Houses wired per 100 farms	Number	111	107
Percentage of farms			
Part-time	Percent	46	52
Farms using electricity in farm operations	Do	58	84
Electrical equipment per 100 farms			
Refrigerators	Number	91	74
Ranges	Do	39	27
Water heaters piped in line	Do	26	8
Irons	Do	110	105
Radios	Do	122	106
Home appliances, all kinds	Do	850	606
Milking machines	Do	7	6
Milk coolers	Do	7	4
Dairy water heaters	Do	6	5
Chick brooders	Do	44	10
Livestock equipment of all kinds	Do	80	34
Shop tools, total all electric	Do	39	14
Average consumption of electricity	KWH	2867	1862

¹For a complete listing of electrical equipment by time of electrification see appendix table 25 to 28.

¹²A straight line regression compiled by the least squares method $Y = -177 + 553X$. Y is the calculated kilowatt-hours. X is total income in thousands of dollars. The standard error of estimate was ± 2080 .

Consumption of electricity averaged 2,867 kilowatt-hours per farm during the calendar year 1948 for the older electrified farms and 1,362 for farms electrified five years or less (table 17). This increase for the older electrified farms seems so great as to suggest further inquiry. If at the end of five or more years these newly electrified farms use as much electricity as the older electrified ones, the older ones in the meantime maintaining their consumption, then the total consumption of electricity for all farms in the sample should increase 34 percent.

Electric consumption in 1948 increased 190 kilowatt-hours per additional year of use of electricity.¹³ Variations above or below the averages, however, were wide. Coefficient of correlation was +.228, thus indicating a rather loose relationship between years of use and kilowatt-hour consumption.

Further information on this subject is available from consumption in years previous to 1948. The average consumption for each calendar year 1939 to 1948 is shown in Appendix Table 29 by number of years electricity had been used on the farms. The average consumption for the first year of use was 313 kilowatt hours in 1939. Those using electricity for the first full year in 1948 averaged 1,133 kilowatt-hours. For all first year users the average was 857 kilowatt-hours. For second year users the average was 1,018 kilowatt-hours. Each additional year of experience with electricity showed added kilowatt-hour consumption up to seven years.

It looks as though part of this increase is due to an upward trend over a period of years as well as additional experience of customers. Three rather important forces bearing on this situation are operating simultaneously in East Tennessee: (a) the tendency for farmers continually to add new equipment as they gain in experience with the use of electricity; (b) the likelihood that farmers now start out their consumption at a much higher level than they did a few years ago, chiefly because of higher farm levels of living and higher levels of technology; and (c) a shift in type of farming from cash crop to livestock (especially dairy), thus encouraging the use of electricity in farming operations.

Up until 1942 each new group of consumers started their consumption at a higher level than the previous group. That condition was interrupted during the war years when equipment was in short supply, but was resumed in 1947 when equipment became more plentiful. All through the period, however, there was a tendency for farmers to increase their use of electricity with years of experience.

Analysis of these schedules indicate that older electrified farms are larger in acreage by about 23 percent, and have 52 percent larger total incomes. Proportionately more were livestock farms (dairy, poultry, and general livestock), and proportionately more of the operators were landlords (table 18).

¹³A straight line trend computed by the least squares method $Y=1091 + 190X$. Y is the calculated kilowatt-hours and X is the number of years of use. Standard error of estimate was ± 3700 .

Table 18—Percentage Distribution of Farms by Type, Tenure of Operator, Acres Operated, Total Income, and Time of Electrification, 492 Farms, East Tennessee, 1948.

Item	Percentage of farms electrified	
	1942 and before	1943 and after
Type of Farm		
Part-time	46	52
Cash crop	21	25
Dairy	15	10
Poultry	2	1
General livestock	7	2
General and self-sufficing	9	10
Total	100	100
Tenure of Operator		
Landlords	19	13
Owners	71	74
Tenants	10	13
Total	100	100
Acres Operated		
Under 10	22	26
10-29	19	20
30-49	14	16
50-99	21	20
100-179	15	12
180 and up	9	6
Total	100	100
Total Income		
Under \$1500	9	14
\$1500-4999	64	70
5000 and up	27	16
Total	100	100

Table 19—Electrical Equipment and Consumption of Electricity Per Farm, by Part-time and Owner Farms, Acreage and Income of Farms, and Time of Electrification, 492 Farms, East Tennessee, 1948.

Item	Farms Electrified	
	1942 and before Number	1943 and after Number
Part-time Farms		
Farms	117	123
Pieces of electrical equipment per 100 farms		
Home	831	596
Livestock	29	15
Shop	39	7
Owner farms		
Farms	179	175
Pieces of electrical equipment per 100 farms		
Home	877	700
Livestock	94	14
Shop	40	14
Farms of 50 to 99 acres		
Farms	53	48
Pieces of electrical equipment per 100 farms		
Home	856	602
Livestock	87	27
Shop	25	27
Farms with income \$1500 to \$4999		
Farms	164	165
Pieces of electrical equipment per 100 farms		
Home	721	468
Livestock	40	21
Shop	27	8
	Kilowatt-hours	Kilowatt-hours
Consumption of electricity per farm, 1948		
Part-time farms	2242	1126
Owner farms	3122	1549
Farms 50 to 99 acres	2465	1143
Farms with incomes \$1500 to \$4999	1708	1208

Schedules were sorted so as to include only the largest group of farms by size, tenure, type, and income.

If then, use of electricity is studied for part-time farms only, then any association of type of farm with electric consumption is eliminated. The consumption of electricity averaged 2,242 kilowatt-hours per part-time farm electrified over five years and 1,126 kilowatt-hours for these connected later (table 19).

In order to eliminate tenure as a factor, sorts were made of all owner-operated farms. Similar results were observed; more electrical equipment and double the kilowatt-hour consumption on the older electrified owner farms in contrast with those wired later.

Likewise for farms of 50 to 99 acres there were 48 percent more electrical appliances of all kinds while consumption of electricity was more than doubled for farms electrified more than five years. Kilowatt-hour consumption averaged 2,465 for the older group and 1,143 per farm for the newer group.

When extremes of incomes were eliminated and only farms with total incomes of from \$1,500 to \$4,999 were included the kilowatt-hour consumption averaged 41 percent greater for the farms using electricity longest.

Part of the increased consumption by older electrified farms may be due to association of such factors as size and income with date of electrification. However, it is apparent that a large part of the increase was due to installation of various kinds of equipment from time to time. This might have been more pronounced if there had been no shortage of new equipment during the war and immediate post-war years.

Summary of Factors.—When the three factors of farm acreage, income, and year of electrification were correlated with kilowatt-hour use of electricity in 1948 a multiple correlation coefficient of $R = +.812$ was found. This indicates that two-thirds of the variability in kilowatt-hours used was explained by income, year of electrification, and farm acreage.¹⁴

It should be recalled, however, that a simple correlation coefficient of $r = +.81$ was found between electric consumption and income. Since income and farm acreage were intercorrelated ($r = +.65$) the relationship of acres to kilowatt-hour consumption in 1948 was mostly due to income rather than to acreage.¹⁵ This is understandable since nine-tenths of the electricity used on farms was in the homes.

¹⁴If X_1 =kilowatt-hours, X_2 =years, X_3 =income in thousands of dollars, and X_4 =acres in units of 10, then the formula for computing kilowatt-hours is as follows:

$$X_1 = a + b \ 12.34 \ X_2 + b \ 13.24 \ X_3 + b \ 14.23 \ X_4$$

Substituting a and b values:

$$X_1 = 1594 + 111.8 \ X_2 + 561.9 \ X_3 + (-17.4X_4)$$

Standard Error of Estimate $S = \pm \ 2183$

Coefficient of Multiple correlation $R = + \ .812$

Coefficient of Multiple determination $R^2 = + \ .668$

¹⁵Coefficient of partial correlation were as follows:

Kilowatt-hour and acres — (income and years constant) $r = -.060$

Kilowatt-hour and income — (acres and years constant) $r = +.738$

Kilowatt hours and years — (acres and income constant) $r = +.228$

Table 20—Approximate Distribution of Electricity Consumed on Farms, 492 Farms, East Tennessee, 1948.

Item	O P E R A T I O N											
	Household					Farm				House-	Percentage Dis-	
	Farms	Light-	Equip-	Water	Total	Light-	Equip-	Water	Total	hold	House-	Farm
		ing	ment	systems		ing	ment	systems		and		
	Number	KWH	KWH	KWH	KWH	KWH	KWH	KWH	KWH	KWH	Percent	Percent
Tenure of operator												
Landlords	81	241	1587	36	1864	13	85	18	116	1980	94.1	5.9
Owners	354	392	2163	14	2569	28	257	7	292	2861	89.8	10.2
Tenants	57	285	752	20	1057	19	272	10	301	1358	77.8	22.2
Type of farm												
Part-time	240	247	1358	28	1633	10	13	14	37	1670	97.8	2.2
Cash crop	114	276	872	16	1164	15	46	8	69	1233	94.5	5.5
Livestock	92	402	2942	88	3432	60	1056	44	1160	4592	74.8	25.2
General and self-suf-												
ficing	46	289	1524	46	1859	19	24	23	66	1925	96.6	3.4
Size of farm												
Under 10 acres	117	243	1312	25	1580	10	9	13	32	1612	98.0	2.0
10-29 acres	98	263	1489	33	1785	11	16	17	44	1829	97.6	2.4
30-49 acres	72	249	1024	22	1295	14	57	11	82	1377	94.1	5.9
50-99 acres	101	270	1354	31	1655	19	148	15	182	1837	90.1	9.9
100-179 acres	67	355	1836	58	2249	30	363	29	422	2671	84.2	15.8
180 and up acres	37	523	3574	112	4209	86	1624	56	1766	5975	70.5	29.5
Total income												
Under \$1500	56	220	783	18	1021	7	11	9	27	1048	97.4	2.6
\$1500-\$4999	329	232	1084	24	1340	12	40	12	64	1404	95.5	4.5
\$5000 and up	107	438	3442	94	3974	55	895	47	997	4971	80.0	20.0
Date of electrification												
1942 and before	254	334	2177	54	2565	31	244	27	302	2867	89.5	10.5
1943 and after	238	236	957	22	1215	10	126	11	147	1362	89.3	10.7
All farms	492	295	1579	38	1912	20	188	19	227	2139	89.4	10.6

ELECTRICITY FOR FARMING OPERATIONS

Estimates of average annual energy requirements for lighting, for household appliances of each kind, and for each piece of electrical farm equipment were applied to these farms. In this way reasonably accurate estimates were placed on energy consumed for household purposes and for farming purposes separately. The estimated consumption for household purposes averaged 1,912 kilowatt-hours, and for farming purposes, 227 kilowatt-hours in 1948 (table 20). Thus approximately 10.6 percent of the total energy was used for farm operations and 89.4 percent for household operations. The groups varied considerably in this respect, however.

Several groups of farms averaged less than 50 kilowatt-hours of electricity for farming purposes during the year: Those with less than \$1,500 of income, those with less than 30 acres of farm land, and part-time farms. Furthermore, the highest consumption for farming purposes was among farms of 180 acres and up, farms with \$5,000 or more of income, and livestock farms. Consumption for farming operations on tenant farms averaged 301 kilowatt-hours. This was above average for all farms. Apparently the inclusion of a few rented dairy farms was responsible for this situation.

Farms recently wired used about the same proportion of electric energy for farming purposes as did those farms with longer use of electricity.

Fifty-three percent of the farms used electricity in homes only.

CHANGES IN FARMING ATTRIBUTABLE TO ELECTRICITY

To determine the effects, if any, that electricity had on farm production or production practices was one objective of this study. Farmers were asked what changes had been made in their farming operations that they would attribute to electrification. A corollary question was asked, "What other causes were responsible for these changes?"

Twenty-nine farmers reported some changes in their dairy enterprise that were brought about by the use of electricity (table 21). For these farmers electrification facilitated the addition of electrically operated dairy equipment such as milk coolers or mechanical milkers, or was accompanied by improved milk houses or barns. The dairies were above average in size, averaging 10 cows per herd before electrification, and 21 at the time of survey. All but one of the herds increased in size. This latter herd was run by an elderly couple who reported that except for electricity they would have had to quit dairying because of age. Their adjustment was to install a milking machine and reduce the number of milk cows from 19 to 11. In this way daily chore time dropped from four to two hours, and was within the capacity of the old couple. Chore hours were decreased on 13 farms from an average of seven hours daily before to four hours after electrification.

Grade of milk was raised from a lower classification to grade "A" on 11 farms. More sanitation and improved milk houses ac-

Table 21—Changes Reported in Dairy Enterprises as a Result of Electrification, 492 Farms, East Tennessee.

Item	Reported Number
Changes reported	
Dairy enterprises	29
Number of cows	
Increases	15
Decreases	1
Cows in herd	
Before installing electricity	10
After installing electricity	21
Chore hours	
Increases	1
Decreases	12
Chore hours per day	
Before installing electricity	7
After installing electricity	4
Grade of milk	
Increase in grade	11
Decrease in grade	1

complicated the installation of electrical equipment on these farms. One man, however, installed a milking machine but did not properly cleanse utensils. Consequently his milk dropped in grade from "A" to "C". He was milking the herd by hand at the time of survey.

Thirty farmers reported changes in poultry enterprises with the coming of electricity (table 22). It appears that these changes came by way of electric brooders which either permitted more chicks to be reared or permitted chick rearing with less labor, or both. Eighteen farmers reported more chicks brooded. The average

Table 22—Changes Reported in Poultry Enterprises as a Result of Electrification, 492 Farms, East Tennessee, 1949.

Item	Reported Number
Changes reported	
Poultry enterprises	30
Number of chicks	
Increases	18
Decreases	0
Chicks brooded	
Before installing electric brooder	36
After installing electric brooder	197
Number of hens	
Increases	9
Decreases	0
Hens in flock	
Before installing electricity	24
After installing electricity	150
Chore hours	
Increases	10
Decreases	0
Chore hours per day during brooding period	
Before installing electricity	2
After installing electricity	1

number brooded was 36 per farm before use of electric brooders and 197 in 1949. Likewise on 9 farms numbers in laying flocks increased from an average of 24 per flock before electric brooding to 150 in 1949. The number of chore hours decreased from an average of two hours per day to one hour on 10 farms. While prices and other factors undoubtedly had some part in these changes it is evident that electricity has aided farmers in their poultry enterprises.

Three farmers reported increases in beef cattle numbers because water was made available for cattle through electric water systems.

A few farmers volunteered the information that food preservation was made easier because of home freezers or that electricity made home work easier, and another stated that work days were lengthened during the winter because of the electric lights in barns.

COMMENTS ON ELECTRIFICATION

General Effects of Electrification.—The persons interviewed were asked as to the general effects electrification had on farming and living aside from those on specific farm enterprises reported earlier. This posed a difficult question inasmuch as once electricity is installed it performs for the various family members at the turn of a switch on uncounted occasions during the day or night. In only a few cases are the daily routines of the farm families abruptly modified.

A compilation of general comments relative to the effect of electricity on farming and living indicated that farmers felt electricity was worth while. Of 422 replies, 414 were to the effect that electricity was of positive value; three of doubtful value, and five of negative value (table 23). Replies that the farmers would not be

Table 23—Summary of Comments on Electricity and Farm Living 422 Farms, East Tennessee, 1949.¹

Comment	Number of Replies
Positive	
Wouldn't be without it	146
Increases the value of the farm	109
Worth more than it costs	43
Nice to have (or like it)	38
Makes living or work easier	28
Worth what it costs	10
Wonderful	9
Saves time, money, or food	8
Worth about what it costs	8
Other favorable replies	15
Total	414
Doubtful ²	3
Negative ³	5
Grand Total	422

¹No replies from 70 cases.

²Includes statements such as; "could do without it", "no effect on farm or living", "Just as soon not have it."

³Includes statements such as; "Costs more than it is worth," "It's dangerous," or, "Prefer a gasoline motor for power on washer."

without electricity were recorded in 146 cases; that it had increased farm values in 109 cases (average where amounts were given \$1,247, median \$500). Many other favorable comments were recorded such as, "It's worth more than it costs"; "It's nice to have"; "It makes living easier"; "Wonderful"; and others.

Electric Service.—The person was also asked whether he (or she) considered central station electric service as a whole satisfactory. This was a general question which was answered in the affirmative 96.7 percent of the times. A little later the question was asked, "Do you consider your present power supply reliable for any farm uses you care to make of it?" This posed a different situation inasmuch as a farmer might be very well satisfied with the performance of installations such as 125-volt service, but at the same time may have been denied a 250-volt outlet for such items as an electric stove or water heater. Answers in 93.7 percent of the cases were to the effect that present power supplies were reliable for all uses.

There were, however, 4.9 percent who reported that their use of electricity was limited due to inadequate power. Chief among these were farmers who were not permitted by suppliers to connect 250-volt circuits to electric ranges. Four people expressed a desire for heavy electric motors to grind feed (one of these a 15-horse-power motor and another a 3-phase motor). Still another wanted a motor large enough to operate a sawmill. Apparently farmers in this area are not thinking in terms of small motor and feed grinder sets. Three persons said they wanted to install electric heat, but were unable to do so because the service was inadequate. Another wanted a water heater.

Another set of limitations revolved around poor performance of equipment already installed arising out of low voltage. This showed up mostly as dim lights and poor radio reception, but other appliances such as refrigerators, washing machines, and electric ranges, were also mentioned as operating poorly under certain conditions. Mention was made that lights were poor during times of meal preparation. Occasionally this condition showed up when neighbors installed some items of equipment such as water heaters or refrigerators.

Another set of problems, annoyances, or grievances arose out of interruptions of electric current. These interruptions or outages were more frequent in areas remote from central distribution stations. At best they were annoyances; at times they were costly. Four and one-half percent of the group reported interruptions that they considered serious. Losses due to interruptions were reported by 4.3 percent of the farmers. Losses ranged from \$1 to \$30 with an average loss of \$14.20 per farm reporting. Most serious was food spoiled in freezers, milk coolers, or refrigerators due to long outages. Loss of chicks in electric brooders was also reported. Three dairy farmers reported that their milk yield had decreased because the cows were milked late due to outages. In general, farmers, who used higher amounts of electricity (2000 kilowatts and up per year)

were most affected both by interruptions and by lack of available power for specific jobs (table 24).

Table 24—*Percentage Distribution of Replies of Farmers Regarding Electric Service by Kilowatt-hour Consumption, 492 Farms, East Tennessee, 1948.*

	Consumption in kilowatt-hours					Total
	Under 500	500- 999	1000- 1999	2000- 4999	5000 and up	
	Num- ber 92	Num- ber 163	Num- ber 111	Num- ber 88	Num- ber 38	Num- ber 492
Farms	Percent	Percent	Percent	Percent	Percent	Percent
Percentage of farms reporting						
Service satisfactory	97.8	98.8	97.3	93.2	92.1	96.7
Power supply reliable	97.8	93.8	93.7	90.9	89.5	93.7
Serious interruptions	3.3	2.5	5.4	3.4	15.8	4.5
Losses due to interruptions	3.3	3.2	4.5	4.5	10.5	4.3 ¹
Standby power	---	---	---	---	5.6	0.4
Use of electricity limited due to lack of available power	3.3	4.3	2.7	9.1	7.9	4.9

¹Average loss reported was \$14.20.

Accidents.—Accidents attributable to electricity were minor on these farms. Only seven such accidents were reported in 1948: two burns and one shock, none of which were reported serious. One cow was killed by contact with a live line. One stove was burned out. The nature of the other two accidents was not reported.

PART III. ELECTRICITY IN RURAL NON-FARM RESIDENCES

WIRING AND APPLIANCES

Extent of Wiring Done.—There is evidence that some of the 79 rural non-farm residences surveyed had been farms at some time. Barns were reported on 15 of the properties and poultry laying houses on 18. However, practically no farming was done on any of them in 1948. Except for the few barns and poultry houses already mentioned practically all out-buildings reported were garages and smoke houses with an occasional wood or coal shed.

Fifty-three percent of the garages were wired as were 7 of the 18 poultry houses (table 25). One-third of the outbuildings were

Table 25—*Number of Buildings and Percentage Wired for Electricity, 79 Rural Non-Farm Residences by Type of Building, 1949.*

Buildings	Buildings			
	Homes	Total	Per 100 homes	Percentage wired
	Number	Number	Number	Percent
Dwellings	79	79	100	100
Garage	19	19	24	53
Smoke house	11	11	14	9
Wood or coal shed	5	5	6	20
Poultry laying house	18	18	23	39
Barns	15	17	22	12
Cribs	4	4	5	0
Other buildings	7	7	9	100
All buildings	158	160	203	67

wired for electricity, thus making a total of 67 percent of all buildings wired.

Yard lights were reported in five cases.

Costs of Wiring.—Data on wiring costs were obtained in 31 cases. In all except three of these wiring was done at the initial time. The average cost for wiring was \$83.39 per homestead. The lowest was \$20 and the highest \$330. The median cost was \$60. In three cases family labor was reported in wiring. In these instances 50 hours of family labor, or 16 hours per home were reported in addition to the cash cost in these instances.

Electrical Equipment.—All of the rural non-farm homes visited had some electrical equipment. The most numerous items were radios and electric irons (table 26). Both of these appliances are relatively light users of electricity under normal home conditions, as were most appliances reported. Washing machines were in 54.4 percent of the homes; hot plates in 40.5 percent; household fans, 30.4 percent; and clocks and toasters 21.5 percent each. Of 16 other appliances in this group none were reported in as many as 20 percent of the homes.

Of the appliances using 360 or more kilowatt-hours a year, refrigerators were the most numerous. They were reported in 73.4 percent of the homes. Ranges were reported in 40.5 percent; water

Table 26—*Electrical Equipment Reported, 79 Rural Non-Farm Residences, East Tennessee, 1949.*

Equipment	Homes reporting	Pieces of equipment per 100 homes	Equipment	Homes reporting	Pieces of equipment per 100 homes
	Percent	No.		Percent	No.
Dwelling			Space heater	17.7	20.2
Heavy users of electricity			Waffle iron	11.4	11.4
Refrigerator	73.4	73.4	Food mixer	11.4	11.4
Range	40.5	40.5	Sewing machine	7.6	7.6
Water heater (pressure type)	15.2	15.2	Razor	7.6	7.6
Freezer	6.3	6.3	Churn	5.1	5.1
Roaster	1.3	1.3	Water heater (emersion type)	3.8	3.8
Air Conditioning	1.3	1.3	Heating pad	2.5	2.5
Light users of electricity			Ironer	2.5	2.5
Iron	97.5	101.3	Coal stoker	1.3	1.3
Radio	96.2	107.6	Milk pasteurizer	1.3	1.3
Washing machine	54.4	54.4	Attic exhaust fan	1.3	1.3
Hot plate	40.5	41.8	Window vent fan	1.3	1.3
Household fan	27.8	30.4	Dishwasher	1.3	1.3
Clock	21.5	21.5	Total	100.0	631.8
Toaster	21.5	21.5	Shop		
Vacuum cleaner	19.0	19.0	Power saw	5.1	5.1
Percolator	17.7	17.7	Tool grinder	3.8	3.8
			Soldering iron	3.8	3.8
			Paint sprayer	2.5	2.5
			Portable drill	2.5	2.5
			Other shop tools	6.4	6.4
			Total shop	12.6	24.1
			Electric water system	20.2	20.2

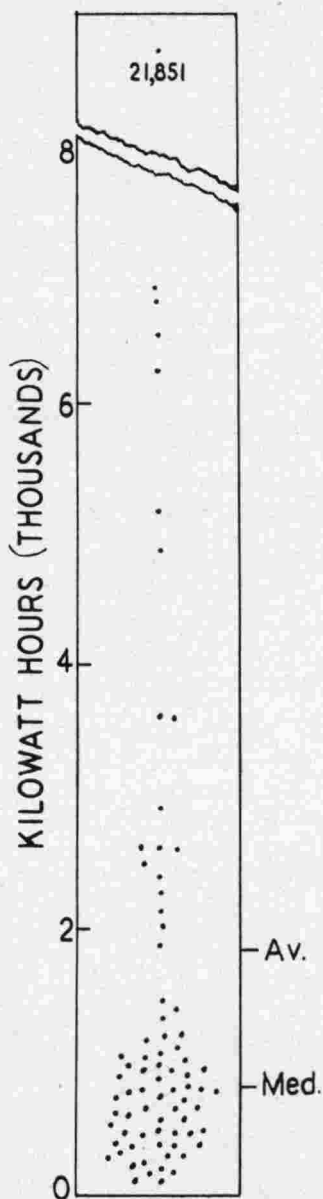
heaters in 15.2 percent; and freezers in 6.3 percent. One roaster and one air-conditioning unit were reported.

Electrically-operated household equipments of all kinds averaged a little more than six pieces per home. This was slightly fewer than was true for farm homes.

There were three electric chick brooders, none of which brooded more than 60 chicks in 1948. No other electrically operated livestock equipment was reported on these places.

There were 4 electrically powered saws, 3 tool grinders, 3 soldering irons, 2 paint sprayers, 2 portable drills, and 5 other electric shop tools reported for the 79 rural residences. A total of 24.1 of these electric tools per 100 residences were reported (table 26). This was only slightly fewer than were found on farms (table 7).

Water Systems.—Twenty-seven of the rural residences had running water. This was about the same proportion as for houses on farms. In 16 of these cases, pumping was by electric pressure systems. Three were home systems with raised reservoirs from which water flowed into the faucets by gravity. Running water was supplied from city systems for five homes and from neighbors' systems in three cases. Bathrooms were reported in 16 cases. Fifty-two homes were without running water.



Average or mean 1851
 Median 838
 Av. dev. from mean ± 1746
 Range = 138 to 21,851

Figure 6.—Rural Non-farm Residences by Consumption of Electricity, 79 Homes, East Tennessee, 1948.

CONSUMPTION OF ELECTRICITY BY RURAL RESIDENCES

Electricity Used, 1948.—Considerable variation existed among non-farm homes in the amounts of electricity used during the 1948 calendar year (fig. 6). One family with 2 rooms of a 3-room house wired and having no equipment other than radio, iron, and household fan used only 138 kilowatt hours during the entire year. The highest user had a 10-room house well equipped with electrical appliances and used 21,851 kilowatt-hours during the year. The average consumption of all 79 residences was 1,851 kilowatt-hours. The median was 838.

Tenure.—Electric energy consumption was related to the tenure status of the occupants of these homes. The rented houses were smaller by one room per dwelling. They were also less well equipped than those occupied by owners. This was evidenced by the fact that 26.6 percent of the owner homes had bathrooms in contrast to 7.5 percent for rented homes (table 27). Incomes were also lower for the tenant families..

Table 27—*Electrical Equipment in Homes and Electricity Consumed, 79 Rural Non-Farm Residences, by Tenure, East Tennessee, 1948.*

Item	Unit	Tenure	
		Owner	Tenant
Residences	Number	51	28
Rooms per dwelling	Do	5.0	3.8
Percentage of homes with bathrooms	Percent	26.6	7.5
Total Income	Dollar	2726	2091
Electrical equipment per 100 homes:			
Refrigerator	Number	78.4	50.0
Range	Do	47.0	28.6
Water heater (pressure type)	Do	23.5	0.0
Total pieces of household equipment	Do	707.5	475.0
Electricity consumed	KWH	2325	990

Average consumption of electricity in 1948 was 2325 kilowatt-hours for owners and 990 for renters. Apparently, rented houses in the open country are less likely to be wired for ranges and other high electricity-consuming appliances, while at the same time families who rent houses are less likely to own other kinds of electric equipment. Incomes were somewhat lower for renters, but apparently not enough so to account for the differences in amounts of electricity used.

Income.—Schedules were sorted into four groups based on total income per family in 1948. Total income of these families more closely approximated spendable income than did that of farm families, inasmuch as these had no farm operating expenses. Apparently 1948 income bore some relationship to that of previous years, for size of dwelling, number of bathrooms, refrigerators, ranges, water heaters, and other electrical equipment increased with income (table 28).

Consumption of electricity also increased for each group of homes as incomes increased. The 1948 consumption averaged 564 kilowatt-hours per home for the low income group and 10,934 kilowatt-hours for the high income group.

Table 28—*Electrical Equipment in Homes and Electricity Consumed, 79 Rural Non-Farm Residences, by Income, East Tennessee, 1948.*

Item	Unit	Total Income			
		Under \$1500	\$1500-2499	\$2500-4999	\$5000 and up
Residences	Number	18	24	32	5
Rooms per dwelling	Do	3.9	3.9	4.8	7.8
Percentages of homes with bathroom	Percent	11.1	12.5	25.0	80.0
Income	Dollars	892	1946	3090	7194
Electrical equipment per 100 homes:					
Refrigerator	Number	44.4	62.5	81.2	100.0
Range	Do	11.1	33.3	53.1	100.0
Water heater (pressure type)	Do	0.0	8.8	15.6	100.0
Total household appliances	Do	327.9	509.9	748.6	1480.0
Electricity consumed	KWH	564	1376	1511	10934

Years Electrified.—The number of years the homes had been electrified bore little if any relationship to 1948 consumption of electricity. Those electrified in 1942 and earlier used an average of 1,788 kilowatt-hours of electricity during 1948 while those electrified in 1943 and since used 1,900 kilowatt-hours. Those electrified in 1942 and before had slightly larger houses and fewer bathrooms. Numbers of electrical appliances and incomes were similar for the two groups (table 29).

Table 29—*Electrical Equipment in Homes and Electricity Consumed 79 Rural Non-Farm Residences, by Year of Electrification, East Tennessee, 1948.*

Item	Unit	Year Electrified	
		1942 and before	1943 and after
Residences	Number	34	45
Rooms per dwelling	Do	4.9	4.2
Percentage of homes with bathrooms	Percent	14.7	24.4
Income	Dollar	2503	2500
Electrical equipment per 100 homes:			
Refrigerator	Number	79.4	68.9
Range	Do	47.0	35.6
Water heater (pressure type)	Do	14.7	15.6
Total pieces of household equipment	Do	639.6	625.7
Electricity consumed	KWH	1788	1900

PART IV. COMPETITION, COSTS, AND FUTURE ESTIMATES

COMPETING KINDS OF POWER

Few sources of energy are as convenient as electricity for household use. However, in some areas in which gas or oil rates are favorable, these fuels become real competitors of electricity for such uses as cooking, water heating, and refrigeration. In this area, however, almost no gas was used in rural homes; only two families in the entire sample reported the use of gas (one for a range and another for a water heater). Kerosene was used as fuel for 3.5 percent of the ranges (2.7 percent for those on farms and 8.9 percent for those in non-farm homes). The main fuel was still wood; 43.6 percent of the ranges were heated with wood. An additional 12.9 percent burned wood and coal. Coal alone was used in 7.5 percent of the ranges (table 30).

Table 30—Percentage of Homes with Electric and Non-Electric Ranges, Refrigerators, and Water Heaters, 492 Farms and 79 Rural Non-Farm Residences, East Tennessee, 1949.

	Houses Reporting Equipment		
	Farm	Non-Farm	Total
	Number	Number	Number
Electrified homes	524	79	603
Ranges:	Percent	Percent	Percent
Electric	31.1	40.5	32.3
Kerosene	2.7	8.9	3.5
Gas	.2	0.0	.2
Wood	44.9	35.4	43.6
Wood and coal	13.7	7.6	12.9
Coal	7.4	7.6	7.5
Total	100.0	100.0	100.0
Refrigerators:			
Electric	78.1	73.4	77.4
Ice	8.0	8.9	8.1
None	13.9	17.7	14.5
Total	100.0	100.0	100.0
Water heaters:			
Electric (in line)	16.4	15.2	16.3
Electric (immersion)	4.2	3.8	4.1
Kerosene	.2	1.3	.3
Gas	.2	0.0	.2
None (or on stove)	79.0	79.7	79.1
Total	100.0	100.0	100.0

Fourteen percent of the homes had no refrigerators; 8 percent had ice refrigerators; the remainder had electric refrigerators. If present trends continue ice soon will be replaced by electric refrigeration in rural homes in this area.

Only one gas and two kerosene water heaters were reported in the total 603 electrified homes (.5 percent of the total). Electric water heaters connected in the hot water system were in 16.3 percent of the homes. Another 4.1 percent reported electric immersion type heaters.

There were 9 farmers reporting chick brooders other than electric; 6 of these were kerosene.

COST OF ELECTRICITY

Farmers paid an average of \$42.63 for electricity during 1948. This averaged 1.99 cents per kilowatt-hour for the 2,139 kilowatt-hours used (table 31). High-income farmers as a group paid a

Table 31—Average Consumption and Cost of Electricity Per Farm 1939-48, and by Income, 1948, 492 Farms, East Tennessee.

Item	Electricity Per Farm		
	Consumption	Total cost	Unit cost
	KWH	Dollars	Cents per KWH
Year			
1948	2139	42.63	1.99
1947	2165	41.95	1.94
1946	1783	36.60	2.05
1945	1527	37.09	2.43
1944	1375	33.99	2.47
1943	1256	33.80	2.66
1942	1038	31.19	3.01
1941	899	32.43	3.61
1940	765	26.98	3.53
1939	654	19.61	3.00
Income 1948			Dollars per \$1000 income
Under \$1500	1048	26.79	24.16
\$1500-4999	1404	35.43	18.16
\$5000 and up	4971	73.04	5.61
Total	2139	42.63	16.34

smaller proportion of their total incomes for electricity than did the low-income farmers. The cost in 1939 averaged \$19.61 for those farms for which data were available. The cost per kilowatt-hour decreased from 3.605 cents in 1941 to 1.94 cents in 1947. Three factors operated to reduce cost per kilowatt-hour: (a) purchase of public utilities by municipalities and integration into the T.V.A. power distribution system; (b) a sliding scale of rates coupled with an increase in amounts of electricity consumed; and, (c) the emergence of non-profit rural electric cooperatives as distributors of electricity in the area.

Apparently a considerable proportion of the farms electrified during 1947 (with 1948 as the first full consumption year) were served by cooperatives which included amortization in the cost of service. As a result, the cost per kilowatt-hour increased slightly in 1948. The average consumption per meter was also slightly less in 1948 than in 1947. Likewise the apparent increase in cost per kilowatt-hour in 1940 and 1941 was probably due to discrepancies in the data arising out of loss of records of the public service systems when they were taken over by municipalities. Most of the consumption and cost data for 1939 were obtained from one distributor who which even then was distributing T.V.A. power.

The 79 non-farm residences paid an average of \$35.09 for electric energy consumed in 1948. This averaged 1.90 cents per kilowatt-hour, which was practically the same as cost per kilowatt-hour for farms.

ESTIMATED FUTURE USE OF ELECTRICITY

Experiences of these families should yield evidences of probable future trends in consumption of electricity on farms and in other rural homes. Consumption increased at the rate of 177 kilowatt-hours annually on the sample farms from 1939 to 1948, and 109 kilowatt-hours per year in rural non-farm residences. If these trends continue at the same rates of increase consumption for the

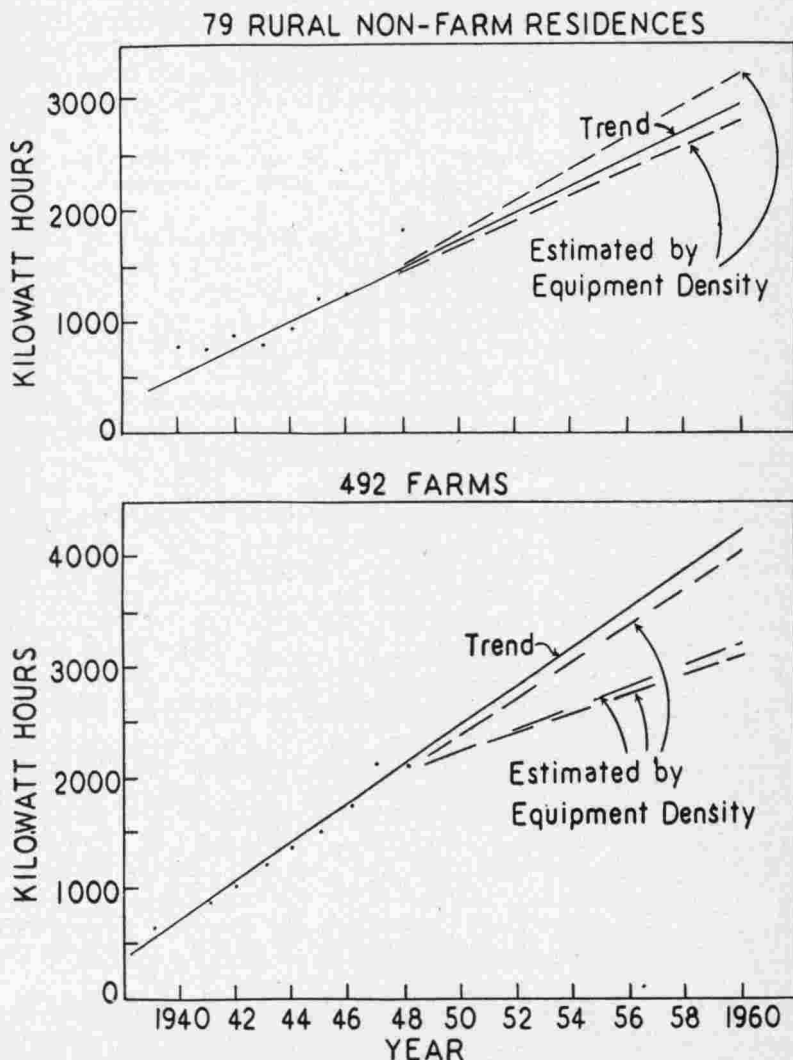


Figure 7.—Trends in Consumption of Electricity, 492 Farms and 79 Rural Non-farm Residences, East Tennessee, 1939-48, and Projections to 1960.

year 1960 would average 4,282 kilowatt-hours for farms and 2,796 kilowatt-hours for non-farm residences (fig. 7). This would be a 101 percent increase over 1948 for farms and a 51-percent increase for non-farms. A twelve-year projection, however, may be subject to considerable error. Will purchasing power increase as rapidly in the next decade as in the past? How many years are required to saturate the present equipment field? How will technology affect the availability and cost of electrical appliances? An inspection of appliance density might help in answering this question.

Electric irons and radios were the only appliances that approached saturation: that is, for which nearly all respondents reported one or more such items. Other items such as household fans and space heaters may not be needed universally, but are in demand as home construction varies.

There were no television sets in the area at the time of the survey but they are expected to come in when broadcasting stations are established nearby.

Likewise the question arises as to whether the introduction of more efficient light bulbs (fluorescent) will not be as rapid as the demand for better home lighting. Some kinds of equipment, however, are kept at restricted numbers either by their original cost, or by the amount of energy required for their operation, or both. Ranges, water heaters, and freezers are good examples of this situation. These three items, plus refrigerators, water systems, and dairy equipment (milkers, coolers, and water heaters), utilized approximately two-thirds of the total electric energy used on farms in this study.

It may reasonably be assumed that by 1960 refrigerators will increase to 95 per 100 farms and the same number per 100 rural non-farm residences; electric ranges increase to 50 and 60; water heaters to 30 and 30; freezers to 30 and 30; and water systems to 50 and 40; and that milking machines, milk coolers, and dairy water heaters will each increase to 10 per 100 farms. Under these assumptions electricity required for the equipment involved would increase 68 percent on farms and 76 percent on non-farm residences (table 32).

The connection of additional homes (farm and non-farm) to distribution systems is another factor which will increase the future demand for electricity in the area. Accurate data concerning the number of homes without electric service in the area are not available. However, the June 30, 1949, estimate for the state as a whole indicated 34 percent of the farms unelectrified. A year later the number had dropped to 18 percent.¹⁶ An estimate of 31 percent without electricity seems reasonable for the time schedules were taken.

Reports from 107 dwellings within a quarter mile of a power line but without electric service indicate that about half of them will probably not be on the market for electricity until some fun-

¹⁶U. S. Department of Agriculture, Rural Electrification Administration, releases October 3, 1949 and October 2, 1950.

Table 32—Consumption of Electrical Energy on Farms and in Rural Non-Farm Homes, 1948 and Estimated 1960, East Tennessee.

Item	Equipment per 100 farms or rural residences					Electric consumption per 100 farms or rural residences						
	Annual Con- sumption	Reported		Estimated		1948	Estimated 1960		1960 as a percentage of 1948			
		Farm	Non- Farm	Farm	Non- Farm		Farm	Non- Farm	Farm	Non- Farm	Farm	Non- farm
KWH	Number	Number	Number	Number	KWH	KWH	KWH	KWH	Percent	Percent		
Selected heavy equipment												
Refrigerator	360	83.1	73.4	95	95	29,916	26,424	34,200	34,200	-----	-----	
Range	1200	33.1	40.5	50	60	39,720	48,600	60,000	72,000	-----	-----	
Water heater	2500 ¹	17.5	15.2	30	30	43,750	38,000	75,000	75,000	-----	-----	
Freezer	900	4.5	6.3	30	30	4,050	5,670	27,000	27,000	-----	-----	
Water system	240 & 150 ²	33.6	20.2	50	40	8,064	2,850	12,000	6,000	-----	-----	
Milking machine	360	6.3	---	10	---	2,268	-----	3,600	-----	-----	-----	
Milk cooler	360	5.7	---	10	---	2,052	-----	3,600	-----	-----	-----	
Dairy water heater	2000	5.1	---	10	---	10,200	-----	20,000	-----	-----	-----	
Total						140,020	121,544	235,400	214,200	168	176	
Lights and other equipment						73,880	63,556					
Grand Total						213,900	185,100					
Estimated 1960 use with increase in heavy equipment and												
Lights and other equipment												
No increase								309,280	277,756	145	150	
20 percent increase								324,056	290,467	151	157	
Increase same as heavy equipment								359,352	325,776	168	176	

¹Bathrooms estimated in half of the homes with running water.²240 KWH for farms and 150 for non-farm residences.

damental changes transpire either in income status, ownership status, or family status.¹⁷ This number will probably not be in the market for electricity within the next 10 years. This would indicate that about five percent of the homes, both farm and rural non-farm, are not likely to be electrified in the near future.¹⁸

If, therefore, the proportion of farms with electric service increases from 69 percent to 95 percent, there will be 38 percent more electrified farms ten years or so hence than at the time of the survey. A similar increase would be realized in the number of rural non-farm dwellings with the service that is in dwellings which were in existence and occupied at the time of the survey.

Still another factor to consider is the probable change in rural population. There are little indications that the number of farms will increase materially in the near future but it does appear that the number of rural residences will increase. Industry has been expanding in the valley for the last quarter century and, due to the growing industrialization there, it appears that still more people will make their homes outside of urban centers in the Valley. Just how great the increase will be can not be foretold. But for purposes of this projection it is assumed that there will be about 30 percent more rural residences in the area a decade or so hence than at the time of the survey. It is also assumed that in the main they will be located on good roads and near urban areas. Consequently they will have electric service available and probably will use it.

It follows, then, that about 68 percent more rural residences are expected to have electric service by 1960 than at the time of the survey. Thirty percent of these are dwellings to be constructed; 38 percent dwellings occupied but without service at the time of the survey.

In summary, total consumption of electricity is expected to be influenced by (a) increased use per farm and per rural residence having the service; (b) extension of service to additional farms and homes that did not have the service at the time of the survey; and (c) the construction of new rural residences. A formula to calculate the total in relation to the total of 1948 is:

$$\frac{(\text{farms} \times a \times b) + (\text{non-farm homes} \times a \times [b+c])}{\text{farms} + \text{non-farm homes}}$$

Substituting figures for each estimate we have the following equations:

High equip.	$(492 \times 1.68 \times 1.38) + (79 \times 1.76 \times 1.68)$	$\times 100 = 241$
density	$\frac{492 + 79}{492 + 79}$	
Med. equip.	$(492 \times 1.51 \times 1.38) + (79 \times 1.57 \times 1.68)$	$\times 100 = 216$
density	$\frac{492 + 79}{492 + 79}$	
Low equip.	$(492 \times 1.45 \times 1.38) + (79 \times 1.50 \times 1.68)$	$\times 100 = 207$
density	$\frac{492 + 79}{492 + 79}$	
Projection of trend	$(492 \times 2.00 \times 1.38) + (79 \times 1.51 \times 1.68)$	$\times 100 = 273$
	$\frac{492 + 79}{492 + 79}$	

¹⁷See section on non-electrified homes, page 43.

¹⁸This should not be construed as indicating that these would be permanently without electric service.

These calculations indicate that rural consumption by all farms and rural residences for the area may be expected to increase 107 to 141 percent by 1960 based on assumed increases in equipment in use. On the basis of projection of the 1939-48 trend the area increase may be expected to be 173 percent.

PART V. HOMES WITHOUT ELECTRIC SERVICE

An attempt was made to obtain information as to why some houses near electric power lines were not served by electricity. Enumerators were instructed to interview residents of any home within one-fourth of a mile from a power line provided the home was in a segment from which an electrified schedule was taken (an electric power line within one-fourth of a mile for at least one and one-half years). Schedules were taken for 107 non-electrified homes, a few of which were outside the segments but on adjacent properties. In addition to these 50 houses on the 492 electrified farms were not wired.

Of the 50 houses on farms from which schedules were taken, 26 were vacant either all or part of the year so that the owner did not feel justified in connecting them.¹⁹ Of the 24 that were occupied, electric service was to be installed shortly in 9. The owners apparently wanted electricity in six others, but suppliers had been unable to serve them up to the time of study. Replies indicated that electric service would probably not be installed in the remaining 9 houses because of expense, condition of building, or other

Table 33—Expressed Reason for Not Having Electricity, 107 Homes Within One-Fourth Mile of Distribution Lines, East Tennessee, 1949.

Reason	Replies ¹	
	Number	
Cost considered too great		
Too costly	19	
Financially unable, etc.	13	
Other	3	
Total		35
Condition of house did not justify wiring		
Waiting to remodel or rebuild	4	
Temporary house	3	
House in too poor condition	3	
Other inadequacies of home or homestead	2	
Total		12
House is rented—owner is not wiring		11
Family is afraid of, or does not like electricity		
Afraid of electricity	5	
Afraid of lightning via electric lines	3	
Electric lights hurt operator's eyes	1	
Total		9
Electricity is either not wanted or not needed		
Landlord doesn't want it	3	
Tenant doesn't want it	3	
No need for it	2	
Total		8
Application for electricity not made or made too late		13
Supplier has not run line—apparently electricity is wanted		13
Electricity to be installed shortly		13
Grand Total		114

¹More than one reason given in some cases.

¹⁹These appear to have been tenant or farm laborer houses which have become vacant due largely to farm mechanization.

reasons.

Occupants of the 107 homes that did not have service and were not on electrified farms stated various reasons for not having electricity (table 33). Thirty-five said that the cost was too great, that is, that either the installation cost was more than the people considered electricity worth, or else the owner was financially unable to wire. In 12 cases, the house did not justify wiring in the owner's opinion. These houses were reported in poor condition, as temporary structures, to be rebuilt, or for some other reason did not justify installation. Eleven replied that their houses were rented from landlords who would not wire. Nine reported a fear of electricity, while 8 stated that electricity was either not wanted or not needed. The replies listed above represented 75 out of 114 (some stated more than one reason) and were to the general effect that some fundamental changes are necessary before these houses are likely to have electric service: attitudes need changing in some cases, in some a new structure is needed, in others a change in ownership would be required, and in still others increased incomes are needed.

The remaining 39 replies indicate the homes that may soon be connected to the power lines. Failure to have the service was reported as follows: the application was made too late for service when the power line was first run; buildings were to be connected shortly; or for some reason the supplier had not built the line, even though the people apparently want electricity.

Of the 107 non-electrified homes 63 were farm homes (36 full-time and 27 part-time), 41 were non-farm homes; 3 were not classified (table 34). The unelectrified farms averaged smaller in

Table 34—*Characteristics of 107 Non-Electrified Farms and Homes Within One-Fourth Mile of a Distribution Line, East Tennessee, 1949.*

	Farm or Home Number	Acreage Per Farm	
		Total Acres	Cropland Acres
Farms			
Full-time	36	61	32
Part-time	27	32	11
Total	63	49	23
Non-farm	41		
Unclassified	3		
Total	107		
Owner	66		
Renter	41		
Total	107		

both total acreage and crop acreage than the electrified farms. Somewhat more of the group as a whole were renters (66 were owners and 41 renters). The average size household was 4.2 persons which is about normal for rural households. There were, however, proportionately more children under 15 years of age and more old people 60 years and over in these homes than for the 17 counties as a whole.

Some of the homes without electricity apparently are on the way to having it. For others, the families appear to be handicapped in one way or another and may not be potential customers until these handicaps are removed.

PART VI. SUMMARY

This is a study of the use of electricity on 492 farms and 79 rural non-farm residences in East Tennessee. Two-thirds of the cases (farm and non-farm) were supplied by municipal distribution systems, and the remainder were supplied by cooperatives. All electric power was generated within the TVA system.

Operator dwellings and about half of the other houses on these farms (farm laborer homes) were wired for electricity. Farms averaged three service buildings, one of which was connected. Milk houses and dairy barns were usually wired for electricity, but other buildings were not usually served.

Costs of installing electricity where cost data were available, averaged \$83.00 per farm. Most farms, however, were wired before the war when prices were lower than at the time of study.

Consumption of electricity averaged 2,139 kilowatt-hours per farm, and 1,851 per rural non-farm residence in 1948. No seasonal pattern was noticeable with respect to electric consumption.

The trend in electric consumption was definitely upward. Farm consumption averaged 654 kilowatt-hours per farm in 1939, and 2,139 in 1948. For rural non-farm residences the increase was from 450 to 1,851 kilowatt-hours.

Density of electrical appliances, especially those using relatively large amounts of electricity such as ranges, water heaters, and freezers lend credence to the belief that the upward trend in consumption will continue for a number of years.

Electricity was used for household and farm production purposes on 47 percent of the farms. An estimated 10.6 percent of the electricity consumed on the 492 farms was for farm production purposes, and the remainder was used by the households. Large, livestock, and high-income farms used proportionately more electricity for farm production purposes than did the others.

Tenure, type of farm, size of farm, income, and date of electrification were all associated with the total amount of electricity consumed on farms in 1948. Farm tenants used an average of 1,358 kilowatt-hours in 1948, owner operators 2,861, and landlords 1,980. Cash crop farms averaged 1,233 kilowatt-hours; part-time farms, 1,670; general and self-sufficing farms, 1,925; and livestock farms (including poultry and dairy), 4,592.

Kilowatt-hours in 1948 increased 20 K.W.H. per acre increase in size of farm. The coefficient of correlation was $+ .501$. Farms under 10 acres averaged 1,612 kilowatt-hours. Those 180 acres or more in size averaged 5,975 kilowatt-hours.

Farms with under \$1,500 total income averaged 1,048 kilowatt-hours in 1948. Those with \$5,000 or more income averaged 4,971 kilowatt-hours. The medium income group averaged 1,404 kilowatt-hours. Kilowatt-hours used increased 553 per \$1,000 increase in income in 1948. The coefficient of correlation was $+ .81$.

Farms that were electrified five years or less averaged 1,362 kilowatt-hours in 1948. Those electrified over five years averaged

2,867 kilowatt-hours. Kilowatt-hour consumption increased 190 per year with a coefficient of correlation of +.228.

Kilowatt-hour consumption for rural non-farm residences showed relationships with tenure and income similar to those for farms. However, date of electrification bore no relation to amount of current used in 1948 for the non-farm group.

Changes in farming attributable to electricity were almost entirely in the livestock enterprises. Twenty-nine of the 492 farmers reported changes in dairying due to electrification. These were largely through the installation of milk coolers, water heaters, and milkers. The changes reported as a result of electrification were more cows, fewer chore hours per cow, and an increase in grade of milk.

Thirty farmers reported changes in poultry, most of which came from installing electric brooders. In addition to reducing chore time, electric brooders encouraged the raising of more chicks, with subsequent increases in size of laying flock..

Farmers were almost unanimous in replying that electricity was of positive value. In only 9 cases was it reported of doubtful or negative value.

In about 5 percent of the cases the use of electricity was reported limited due to inadequate power such as 110 volt lines when 220 volt equipment was desired. Other problems in electric service were interruptions or outages, and low voltage.

Farmers paid an average of \$42.63 for electric current during 1948. This was at the rate of 1.99 cents per kilowatt-hour. In 1939 they paid \$19.61 for electricity; the rate being 3.0 cents per kilowatt-hour. The 79 non-farm consumers paid an average of \$35.09 for the year 1948.

Reports from unelectrified dwellings within one-fourth of a mile of a power line indicate that certain impending factors are likely to keep about one-half of these dwellings from electrifying until these impediments are removed.

If the trend in consumption of electricity from 1939 to 1948 were to continue at the same rate until 1960 these farms will then use an average of approximately 4,300 kilowatt-hours. The non-farm group would then be using 2,800 kilowatt-hours each. This would represent a 101-percent increase in electricity on farms, and an increase of 51 percent for non-farmers.

Estimated use by 1960 based on varying degrees of appliance density indicate increases of from one-half to three-fourths for farms and for non-farm homes.

After allowing for reasonable increases in non-farm population and for electrification of 95 percent of all homes, the area estimates would vary from a 107-percent to a 141-percent increase over 1948 based on different levels of appliance density. Should the present trend of consumption of electricity on farms and other rural homes continue at the same rate as during the last 9 years, and should the same assumptions prevail as to population increase and extension to other homes, then total rural electric consumption would increase 173 percent.

PART VII. APPENDIX

Table 1—Number of Buildings Wired by Date of Farm Electrification and by Type of Farm, 492 Farms, East Tennessee, 1948.

	Electrified		Part-time	Type of Farm		
	1942 and before	1943 and after		Cash Crop	Live-stock	General
	Number	Number	Number	Number	Number	Number
Total Farms	254	238	240	114	92	46
Farm Operation						
General barn	93	39	43	28	47	14
Dairy barn	20	11	2	4	24	1
Milk house	16	7	1	2	19	1
Hog house	0	0	0	0	0	0
Poultry laying house	43	14	22	13	16	6
Poultry brooder house	24	7	11	5	13	2
Implement shed	9	0	1	1	4	3
Crib	5	4	0	3	4	2
Shop	18	4	10	2	7	3
Feed and storage	6	2	1	1	3	3
Tobacco barn	2	0	0	0	1	1
Other buildings	36	11	18	7	15	7
Household Operation						
Dwellings	282	255	249	120	116	52
Smoke house	19	12	14	11	4	2
Garage	34	8	23	7	6	6
Yard lights	29	19	21	5	15	7

Table 2—Number of Buildings Wired by Size of Farm, 492 Farms, East Tennessee, 1948.

Item	Acres in Farm					
	Under 10	10-29	30-49	50-99	100-179	180 and up
	Number	Number	Number	Number	Number	Number
Total farms	117	98	72	101	67	37
Farm operation						
General barn	20	19	18	31	24	20
Dairy barn	3	1	1	7	6	14
Milk house	0	0	0	1	5	17
Hog house	0	0	0	0	0	0
Poultry laying house	11	11	9	12	7	6
Poultry brooder house	6	5	4	6	5	5
Implement shed	0	1	2	1	0	5
Crib	0	1	1	2	2	3
Shop	5	0	5	4	2	6
Feed Storage	0	0	1	3	1	3
Tobacco barn	0	0	0	1	1	0
Other buildings	4	11	9	11	8	4
Household operation						
Dwellings	119	103	74	109	74	58
Smoke house	9	7	3	7	4	1
Garage	8	8	6	7	8	5
Yard lights	11	6	8	10	7	6

Table 3—Number of Buildings Wired by Tenure Status and Income, 492 Farms, East Tennessee, 1948.

Item	Tenure Status			Total Income		
	Land-lords	Owners	Tenants	Under \$1500	\$1500-4999	\$5000 and up
	Number	Number	Number	Number	Number	Number
Total farms	81	354	57	56	329	107
Farm operation						
General barn	17	100	15	5	75	52
Dairy barn	3	24	4	0	8	23
Milk house	1	15	7	1	4	12
Hog house	0	0	0	0	0	0
Poultry laying house	7	47	3	5	33	19
Poultry brooder house	7	24	0	2	11	18
Implement shed	1	8	0	1	3	5
Crib	0	7	2	1	3	5
Shop	4	17	1	1	10	11
Feed storage	0	7	1	1	2	5
Tobacco barn	0	2	0	0	0	2
Other buildings	10	36	1	7	28	12
Household operation						
Dwellings	88	394	60	57	343	137
Smoke house	7	21	3	0	23	8
Garage	5	37	0	5	21	16
Yard lights	6	40	2	5	24	19

Table 4—Characteristics of Farms by Tenure of Operator, 492 Farms, East Tennessee, 1948.

Item	Unit	Tenure of Operator			
		Land-lord	Owner	Tenant	All farms
Farms	Number	81	354	57	492
Acreage					
Operated	Acre	45.5	70.9	56.7	65.1
Cropland	Do	9.8	33.1	31.4	29.1
Milk cows per farm	Number	2.1	4.2	3.8	3.8
Spring pigs raised	Do	.9	2.6	1.2	2.1
Chicks raised	Do	51	63	33	57
Income per farm					
Sale	Dollar	638	2166	2421	1944
Farm products used	Do	437	527	508	510
Off-farm	Do	2286	1721	1026	1734
Total	Do	3361	4414	3955	4188
Years on present farm	Year	24	16	5	16
Previous experience on electrified farms					
Reporting	Number	25	132	27	184
Average number years	Year	1.3	2.1	1.6	1.9
Operator dwellings wired					
Houses wired	Number	81	358	57	496
Average rooms wired	Do	5.9	5.6	4.5	5.6
Other houses wired					
Farms reporting	Do	2	27	3	32
Houses wired	Do	2	39	3	44
Average rooms wired	Do	5.5	4	3.7	4.1
Houses not wired					
Houses	Do	5	36	1	42
Farms reporting	Do	6	43	1	50
Average rooms	Do	5.2	3.9	2	3.4

Table 5—Characteristics of Farms by Type, 492 Farms, East Tennessee, 1948.

Item	Unit	Type of Farm			
		Part-time	Cash Crop	Live-stock	General and self-sufficing
Farms	Number	240	114	92	46
Acreage					
Operated	Acre	28	83	120	80
Cropland	Do	9	47	56	34
Milk cows per farm	Number	1	3	12.3	3.7
Spring pigs raised per farm	Do	0.6	2.1	5.8	2.6
Chicks raised per farm	Do	55	56	68	52
Income per farm					
Sale	Dollar	196	2309	5946	2154
Farm products used	Do	401	569	673	609
Off farm	Do	2428	577	1821	804
Total	Do	3025	2446	8440	3567
Years on present farm	Year	14	14	21	20
Previous years in electrified farms					
Reporting	Number	92	45	31	16
Average number of years	Year	1.6	2.1	2.6	2.1
Operator dwellings wired					
Houses wired	Number	240	115	94	47
Average rooms wired	Do	5.4	5	6.5	5.8
Other houses wired					
Farms reporting	Do	10	5	12	5
Houses wired	Do	10	5	24	5
Average rooms wired	Do	3.6	4.2	4.3	3.8
Houses not wired					
Farms reporting	Do	11	13	13	5
Houses	Do	11	14	19	6
Average rooms	Do	3.2	3.4	3.4	3.5

Table 6—Characteristics of Farms by Farm Acreage, 492 Farms, East Tennessee, 1948.

Item	Unit	Acres Operated					
		Under 10	10-29	30-49	50-99	100-179	180 and up
Farms	Number	117	97	72	101	67	38
Acreage							
Operated	Acre	4	18	38	73	129	262
Cropland	Do	1	9	20	33	57	124
Livestock per farm							
Milk cows	Number	0.9	1.1	2.5	4.5	5.6	16.8
Spring pigs raised	Do	0.6	1.6	0.6	3.5	3.3	5.3
Chicks raised	Do	70	49	49	54	56	71
Income per farm							
Sale	Dollar	237	587	1327	1889	3429	9591
Farm products used	Do	398	408	494	581	580	851
Off-farm	Do	2343	1963	1324	1297	1664	1314
Total	Do	2978	2958	3145	3767	5673	11766
Years on present farm	Year	12	14	14	16	22	23
Previous years on electrified farms							
Reporting	Number	55	32	22	36	24	15
Average number years	Year	1.5	2.2	1.6	2.1	2.5	2.1
Operator dwellings wired							
Houses	Number	117	98	72	103	68	38
Average rooms wired	Do	4.9	5.2	5.2	5.5	5.9	6.2
Other houses wired							
Farms reporting	Do	2	5	2	6	7	10
Houses	Do	2	5	2	6	7	22
Average rooms wired	Do	3	2.6	3.5	4	4.6	4.4
Houses not wired							
Farms reporting	Do	2	4	4	10	14	8
Houses	Do	2	4	4	11	15	14
Average rooms	Do	3.5	2.3	2.3	3.6	3.7	3.5

Table 7—Characteristics of Farms by Income, 492 Farms, East Tennessee, 1948.

Item	Unit	Income Per Farm		
		Under \$1500	\$1500-4999	\$5000 and over
Farms	Number	56	329	107
Acreage				
Operated	Acre	31	48	124
Cropland	Do	14	21	63
Livestock per farm				
Milk cows	Number	0.9	2.3	10.1
Spring pigs raised	Do	0.2	1.4	5.2
Chicks raised	Do	36	83	68
Income Per Farm				
Sale	Dollar	246	934	5937
Farm products used	Do	334	481	694
Off farm	Do	473	1557	2934
Total	Do	1053	2972	9565
Years on present farm	Year	22	14	18
Previous years in electrified farms				
Reporting	Number	18	126	40
Average number years	Year	1.6	1.8	2.4
Operator dwellings wired				
Houses wired	Number			
Average rooms wired	Do	5.2	5.3	6.4
Other houses wired				
Farms reporting	Do	1	13	18
Houses wired	Do	1	13	30
Average rooms wired	Do	3.0	3.8	4.2
Houses not wired				
Farms reporting	Do	2	26	14
Houses	Do	2	28	20
Average rooms	Do	3.5	3.2	3.6

Table 8—Characteristics of Farm by Time of Electrification, 492 Farms, East Tennessee, 1948.

Item	Unit	Year of Electrification	
		1942 and before	1943 and after
Farms	Number	254	238
Acreage			
Operated	Acre	69	56
Cropland	Do	31	27
Livestock per farm			
Milk cows	Number	4.6	3
Spring pigs raised	Do	2.9	1.3
Chicks raised	Do	67	48
Income per farm			
Sale	Dollar	2423	1432
Farm products used	Do	523	497
Off farm	Do	1944	1508
Total	Do	4890	3437
Years on present farm	Year	19	13
Previous years in electrified farms			
Reporting	Number	98	86
Average number of years	Year	1.9	2
Operator dwellings wired			
Houses	Number	257	239
Average rooms wired	Do	5.9	5.2
Other houses wired			
Farms reporting	Do	17	15
Houses	Do	27	17
Average rooms wired	Do	4.2	3.9
Houses not wired			
Farms reporting	Do	18	24
Houses	Do	24	26
Average rooms	Do	3.7	3.1

Table 9—*Electric Household Equipment in Farm Homes, 492 Farms Classified by Tenure, East Tennessee, 1949.*

	Farms Reporting Equipment				Pieces of Equipment Per 100 Farms			
	Land-	Owners	Tenants	Total	Land-	Owners	Tenants	Total
	lords				lords			
	Percent	Percent	Percent	Percent	Number	Number	Number	Number
Heavy users of electricity								
Refrigerator	82.7	83.0	48.3	78.9	83.9	88.4	50.0	83.1
Range	44.4	31.4	19.0	32.1	44.4	32.9	19.0	33.1
Water heater (pres. type)	19.7	17.8	1.7	16.3	19.7	19.5	1.7	17.5
Freezer	7.4	4.5	0.0	4.5	7.4	5.1	0.0	4.9
Roaster	4.9	3.1	1.7	3.3	4.9	3.1	1.7	3.3
Air Conditioning	1.2	.3	0.0	.4	1.2	.3	0.0	.4
Light users of electricity								
Iron	98.8	97.7	94.8	97.6	103.7	109.3	101.7	107.5
Radio	93.8	94.9	93.1	94.5	103.7	117.3	101.7	114.2
Washing machine	74.1	82.7	51.7	77.6	75.3	89.3	51.7	82.3
Hot plate	38.3	43.6	27.6	40.9	39.5	45.9	27.6	42.7
Household fan	40.7	30.3	17.2	30.5	51.9	32.9	17.2	34.1
Churn	29.6	30.6	17.2	28.9	30.9	31.2	17.2	29.5
Clock	21.0	29.5	6.9	25.4	21.0	32.9	6.9	27.8
Vacuum cleaner	30.9	26.6	6.9	25.0	30.9	27.5	6.9	25.6
Toaster	27.2	24.6	6.9	23.0	27.2	26.6	6.9	24.4
Percolator	23.5	18.4	5.2	17.7	23.5	19.0	5.2	18.1
Heating Pad	21.0	15.3	.3	14.6	23.5	17.3	1.7	16.5
Space heater	18.5	14.7	5.2	14.2	24.7	19.0	5.2	18.3
Waffle iron	13.6	11.0	3.4	10.6	13.6	11.3	3.4	10.8
Food mixer	7.4	9.6	3.4	8.5	8.6	10.2	3.4	9.1
Sewing machine	3.7	5.9	3.4	5.3	3.7	5.9	3.4	5.3
Razor	2.5	6.5	0.0	5.1	2.5	6.8	0.0	5.3
Water heater (immersion)	3.7	4.5	3.4	4.3	3.7	4.8	3.4	4.5
Broiler	3.7	2.5	1.7	2.6	3.7	2.5	1.7	2.6
Ironer	0.0	2.3	1.7	1.8	0.0	2.3	1.7	2.6
Record player	1.2	1.7	0.0	1.4	1.2	1.7	0.0	1.4
Coal stoker	1.2	1.4	0.0	1.2	1.2	1.4	0.0	1.2
Hot air fan	1.2	1.4	0.0	1.2	1.2	1.4	0.0	1.2
Blanket	0.0	1.4	0.0	1.0	0.0	1.4	0.0	1.0
Milk pasteurizer	0.0	1.1	0.0	.8	0.0	1.4	0.0	1.0
Attic exhaust fan	0.0	.6	1.7	.6	0.0	.6	1.7	.6
Kitchen exhaust fan	1.2	.3	0.0	.4	1.2	.3	0.0	.4
Window vent fan	0.0	.6	0.0	.4	0.0	.6	0.0	.4
Meat grinder	1.2	.3	0.0	.4	1.2	.3	0.0	.4
Dishwasher	0.0	.3	0.0	.2	0.0	.3	0.0	.2
Oil furnace	0.0	.3	0.0	.2	0.0	.3	0.0	.2
Clothes drier	0.0	.3	0.0	.2	0.0	.3	0.0	.2
Other	3.7	2.3	1.7	2.4	3.7	2.5	1.7	2.6
Total					762.8	773.7	442.7	733.5

Table 10—*Electric Livestock Equipment on Farms, 492 Farms Classified by Tenure, East Tennessee, 1949.*

Equipment	Farms reporting equipment				Pieces of equipment per 100 farms			
	Land-	Owners	Tenants	Total	Land-	Owners	Tenants	Total
	lords				lords			
	Percent	Percent	Percent	Percent	Number	Number	Number	Number
Dairy equipment								
Heavy users of electricity								
Milking machines	2.5	5.9	7.0	5.5	2.5	6.8	8.8	6.3
Milk cooler	2.5	5.6	7.0	5.3	2.5	6.2	7.0	5.7
Water heater	2.6	4.5	8.8	4.7	2.6	5.1	8.8	5.1
Light users of electricity								
Cream separator	1.2	1.1	0.0	1.0	1.2	1.1	0.0	1.0
Churn	1.2	.6	0.0	.6	1.2	.6	0.0	.6
Radio	0.0	.3	0.0	.2	0.0	.3	0.0	.2
Poultry equipment								
Chick brooder-hover	17.3	17.2	5.3	15.8	17.3	28.5	5.3	24.0
Chick brooder-battery	4.9	3.1	0.0	3.0	4.9	4.0	0.0	3.6
Egg incubators	0.0	.6	0.0	.4	0.0	.8	0.0	.6
Water warmer	0.0	.6	0.0	.4	0.0	.6	0.0	.4
Other equipment								
Fence controller	2.5	10.4	0.0	7.9	2.5	11.6	0.0	8.7
Stock clippers	1.2	.8	0.0	.8	1.2	1.1	0.0	1.0
Ventilating fan	0.0	.3	0.0	.2	0.0	.3	0.0	.2
Total					35.9	60.0	29.9	57.4
Lights								
Dairy	4.9	7.6	8.8	7.3				
Poultry	3.7	2.8	0.0	2.6				
Other	6.1	6.5	28.6	6.1				

Table 11—*Electric Shop Equipment on Farms, 492 Farms, Classified by Tenure, East Tennessee, 1949.*

Equipment	Farms reporting equipment				Pieces of equipment per 100 farms			
	Land-	Owners	Tenants	Total	Land-	Owners	Tenants	Total
	lords				lords			
	Percent	Percent	Percent	Percent	Number	Number	Number	Number
Tool grinder	7.4	8.5	10.5	8.5	7.4	8.9	10.5	8.7
Saw (bench includ. band)	3.7	3.7	1.8	3.4	3.7	4.0	3.5	3.9
Portable drill	3.7	2.8	0.0	2.6	3.7	2.8	0.0	2.6
Soldering iron	2.5	2.5	1.8	2.4	2.5	3.1	1.8	2.8
Drill press	2.5	1.4	0.0	1.4	2.5	1.4	0.0	1.4
Jointers	1.2	1.1	1.8	1.2	1.2	1.1	1.8	1.2
Lathe	0.0	.8	1.8	.8	0.0	1.1	1.8	1.0
Air compressors	0.0	.8	1.8	.8	0.0	.8	1.8	.8
Sanders	1.2	.3	3.5	.8	1.2	.3	3.5	.8
Planers	1.2	.6	0.0	.6	1.2	.6	0.0	.6
Battery charger	1.2	.6	0.0	.6	1.2	.6	0.0	.6
Jig saw	0.0	.6	0.0	.4	0.0	.6	0.0	.4
Concrete mixer	0.0	.6	0.0	.4	0.0	.6	0.0	.4
Paint sprayer	0.0	.3	1.8	.4	0.0	.3	1.8	.4
Others	1.2	1.1	1.8	1.2	1.2	1.1	1.8	1.2
Total shop					25.8	27.3	28.3	26.8

Table 12—*Other Miscellaneous Electrical Equipment on Farms, 492 Farms, Classified by Tenure, East Tennessee, 1949.*

Equipment	Farms reporting equipment				Pieces of equipment per 100 farms			
	Land-	Owners	Tenants	Total	Land-	Owners	Tenants	Total
	lords				lords			
	Percent	Percent	Percent	Percent	Number	Number	Number	Number
Wood saw	0.0	.6	0.0	.4	0.0	.6	0.0	.4
Seed cleaner	0.0	.6	0.0	.4	0.0	.6	0.0	.4
Corn sheller	1.2	.3	0.0	.4	1.2	.3	0.0	.4
Total					1.2	1.5	0.0	1.2

Table 13—*Electric Household Equipment in Farm Homes, 492 Farms Classified by Type of Farm, East Tennessee, 1948.*

Equipment	Farms reporting equipment					Pieces of equipment per 100 farms				
	Part-time	Cash crop	Live-stock	General and self-sufficing	Total	Part-time	Cash crop	Live-stock	General and self-sufficing	Total
Percent Percent Percent Percent Percent Percent Number Number Number Number Number										
Heavy users of electricity										
Refrigerator	79.6	68.7	91.2	76.1	78.9	81.7	70.4	105.5	78.3	83.1
Range	35.0	16.5	47.2	26.1	32.1	35.4	16.5	51.6	26.1	33.1
Water heater (pressure)										
Roaster	16.3	5.2	27.5	21.7	16.3	16.3	5.2	33.0	23.9	17.5
Aid conditioning	2.1	0.0	6.6	0.0	3.3	2.1	0.0	6.6	0.0	3.3
	.4	0.0	1.1	0.0	.4	.4	0.0	1.1	0.0	.4
Light users of electricity										
Iron	97.9	97.4	98.9	93.5	97.6	103.7	103.5	124.2	104.3	107.5
Radio	95.0	93.0	94.5	95.7	94.5	111.7	103.5	129.7	123.9	114.2
Washing machine	78.3	73.9	80.7	67.4	77.6	80.8	74.8	100.0	71.7	82.3
Hot plate	38.7	32.2	54.9	45.7	40.9	40.8	33.0	56.0	50.0	42.7
Household fan	31.7	25.2	36.3	26.1	30.5	33.7	26.1	47.3	30.4	34.1
Churn	27.1	31.3	23.0	23.9	28.9	27.5	31.3	35.2	23.9	20.5
Clock	24.2	15.7	36.3	34.8	25.4	25.8	19.1	40.7	34.8	27.8
Vacuum cleaner	22.9	13.0	42.9	30.4	25.0	22.9	13.0	46.1	30.4	25.6
Toaster	20.8	15.7	39.6	19.6	23.0	20.8	16.5	46.1	19.6	24.4
Percolator	20.0	11.3	24.2	8.7	17.7	20.0	11.3	26.4	8.7	18.1
Heating pad	12.5	7.8	29.7	13.0	14.6	13.7	8.7	35.2	13.0	16.5
Space heater	15.4	5.2	24.2	10.9	14.2	20.0	8.9	31.9	10.9	18.3
Waffle iron	10.0	5.2	19.8	8.7	10.6	10.0	5.2	20.9	8.7	10.8
Food mixer	7.5	6.1	15.4	6.5	8.5	7.9	6.1	17.6	6.5	9.1
Sewing machine	5.4	2.6	7.7	6.5	5.3	5.4	2.6	7.7	6.5	5.3
Razor	4.2	3.5	9.9	4.3	5.1	4.6	3.5	9.9	4.3	5.3
Water heater (Im'rsion)										
Broiler	5.0	3.5	3.3	4.3	4.3	5.0	3.5	3.3	6.5	4.5
Ironer	1.7	1.7	1.7	0.0	2.6	1.7	1.7	1.7	0.0	2.6
Record player	2.1	.9	3.3	0.0	1.8	2.1	.9	3.3	0.0	1.8
Coal stoker	2.5	.9	0.0	0.0	1.4	2.5	.9	0.0	0.0	1.4
Hot air fan	.8	.9	3.3	0.0	1.2	.8	.9	3.3	0.0	1.2
Blanket	.8	.9	2.2	2.2	1.2	.8	.9	2.2	2.2	1.2
	1.3	0.0	2.2	0.0	1.0	1.3	0.0	2.2	0.0	1.0
Milk pasteurizer	.4	.9	2.2	0.0	.8	.4	.9	3.3	0.0	1.0
Attic exhaust fan	0.0	0.0	1.1	4.3	.6	0.0	0.0	1.1	4.3	.6
Kitchen exhaust fan	.4	.9	0.0	0.0	.4	.4	.9	0.0	0.0	.4
Window vent fan	.8	0.0	0.0	0.0	.4	.8	0.0	0.0	0.0	.4
Meat grinder	.4	0.0	1.1	0.0	.4	.4	0.0	1.1	0.0	.4
Dishwasher	.4	0.0	0.0	0.0	.2	.4	0.0	0.0	0.0	.2
Oil Furnace	0.0	0.0	1.1	0.0	.2	0.0	0.0	1.1	0.0	.2
Clothes drier	0.0	0.0	1.1	0.0	.2	0.0	0.0	1.1	0.0	.2
Other	2.9	2.6	1.1	2.2	2.4	2.9	3.5	1.1	2.2	2.6
Total						607.6	571.3	1017.8	699.8	733.5

Table 14—*Electric Livestock Equipment on Farms, 492 Farms Classified by Type of Farm, East Tennessee, 1949.*

Equipment	Farms reporting equipment					Pieces of equipment per 100 farms				
	Part-time	Cash crop	Live-stock	General and self-sufficing	Total	Part-time	Cash crop	Live-stock	General and self-sufficing	Total
Percent Percent Percent Percent Percent Number Number Number Number Number										
Dairy Equipment										
Heavy users of electricity										
Milking machine	0.0	1.8	27.2	0.0	5.5	0.0	1.8	31.5	0.0	6.3
Milk cooler	0.0	.9	27.2	0.0	5.3	0.0	.9	29.3	0.0	5.7
Water heater	0.0	.9	23.9	0.0	4.7	0.0	.9	26.1	0.0	5.1
Light users of electricity										
Cream separator	.4	1.8	2.2	0.0	1.0	.4	1.8	2.2	0.0	1.0
Churn	.4	0.0	2.2	0.0	.6	.4	0.0	2.2	0.0	.6
Radio	0.0	0.0	1.1	0.0	.2	0.0	0.0	1.1	0.0	.2
Poultry Equipment										
Chick brooder-hoyer	10.8	15.8	26.1	21.7	15.8	10.8	17.5	67.4	21.7	24.0
Chick brooder-battery	3.3	.9	6.5	0.0	3.0	3.8	.9	8.7	0.0	3.6
Egg incubator	.8	0.0	0.0	0.0	.4	1.2	0.0	0.0	0.0	.6
Water warmer	0.0	0.0	2.2	0.0	.4	0.0	0.0	2.2	0.0	.4
Other Equipment										
Fence controller	5.0	6.1	15.2	13.0	7.9	5.4	6.1	18.5	13.0	8.7
Stock clippers	0.0	0.0	4.3	0.0	.8	0.0	0.0	5.4	0.0	1.0
Ventilating fan	0.0	0.0	1.1	0.0	.2	0.0	0.0	1.1	0.0	.2
Total						22.0	29.9	195.7	34.7	57.4
Lights										
Dairy	.8	5.3	30.4	0.0	7.3					
Poultry	1.7	1.8	6.5	2.2	2.6					
Other	2.5	6.1	15.2	6.5	6.1					

Table 15—*Electric Shop Equipment on Farms Classified by Type of Farm, East Tennessee, 1949.*

Equipment	Farms reporting equipment					Pieces of equipment per 100 farms				
	Part-time	Cash crop	Live-stock	General and self-sufficing	Total	Part-time	Cash crop	Live-stock	General and self-sufficing	Total
	Percent	Percent	Percent	Percent	Percent	Number	Number	Number	Number	Number
Tool grinder	5.4	6.1	17.4	13.0	8.5	5.4	6.1	18.5	13.0	8.7
Saw (bench including band)	3.3	.9	5.4	6.5	3.4	3.8	.9	5.4	8.7	3.9
Portable drill	2.9	0.0	4.3	4.3	2.6	2.9	0.0	4.3	4.3	2.6
Soldering iron	2.5	0.0	3.3	6.5	2.4	3.3	0.0	3.3	6.5	2.8
Drill press	1.7	0.0	2.2	2.2	1.4	1.7	0.0	2.2	2.2	1.4
Jointers	1.2	.9	1.1	2.2	1.2	1.2	.9	1.1	2.2	1.2
Lathe	1.2	0.0	0.0	2.2	.8	1.7	0.0	0.0	2.2	1.0
Air compressors	.4	0.0	2.2	2.2	.8	.4	0.0	2.2	2.2	.8
Sanders	.4	.9	0.0	2.2	.8	.4	.9	0.0	2.2	.8
Planers	.4	.9	1.1	0.0	.6	.4	.9	1.1	0.0	.6
Battery charger	.8	0.0	1.1	0.0	.6	.8	0.0	1.1	0.0	.6
Jig saw	.4	0.0	0.0	2.2	.4	.4	0.0	0.0	2.2	.4
Concrete mixer	0.0	.9	1.0	0.0	.4	0.0	.9	1.1	0.0	.4
Paint sprayer	.4	0.0	0.0	1.1	.4	.4	0.0	0.0	1.1	.4
Others	.8	0.0	2.2	4.3	1.2	.8	0.0	2.2	4.3	1.2
Total						23.6	10.6	42.5	51.1	26.8

Table 16—*Other Miscellaneous Electrical Equipment on Farms, 492 Farms Classified by Type of Farm, East Tennessee, 1949.*

Equipment	Farms reporting equipment					Pieces of equipment per 100 farms				
	Part-time	Cash crop	Live-stock	General and self-sufficing	Total	Part-time	Cash crop	Live-stock	General and self-sufficing	Total
	Percent	Percent	Percent	Percent	Percent	Number	Number	Number	Number	Number
Wood saw	.4	0.0	1.1	0.0	.4	.4	0.0	1.1	0.0	.4
Seed cleaner	0.0	.9	0.0	2.2	.4	0.0	.9	0.0	2.2	.4
Corn sheller	0.0	.9	0.0	2.2	.4	0.0	.9	0.0	2.2	.4
Total						.4	1.8	1.1	4.4	1.2

Table 17—Electric Household Equipment in Farm Homes, 492 Farms Classified by Acres Operated, East Tennessee, 1949.

Equipment	Farms reporting equipment							Pieces of equipment per 100 farms						
	Under						Total	Under						Total
	10 acres	10-29 acres	30-49 acres	50-99 acres	100-179 acres	180 and up		10 acres	10-29 acres	30-49 acres	50-99 acres	100-179 acres	180 and up	
	Per- cent	Per- cent	Per- cent	Per- cent	Per- cent	Per- cent	Per- cent	Num- ber	Num- ber	Num- ber	Num- ber	Num- ber	Num- ber	Num- ber
Heavy users of electricity														
Refrigerator	82.0	73.5	70.8	83.0	60.9	83.8	78.9	83.8	74.5	72.2	86.0	82.3	118.9	83.1
Range	32.5	40.8	23.6	27.0	27.9	45.9	32.1	32.5	41.8	23.6	28.0	27.9	54.1	33.1
Water heater (pressure)	15.4	16.3	8.3	16.0	13.2	40.5	16.3	15.4	16.3	8.3	16.0	17.6	40.5	17.5
Freezer	.8	5.1	5.6	4.0	5.9	10.8	4.5	.8	5.1	5.6	4.0	7.4	13.5	4.9
Roaster	2.6	4.1	1.4	2.0	1.5	13.5	3.3	2.6	4.1	1.4	2.0	1.5	13.5	3.3
Air conditioning	.8	0.0	0.0	0.0	0.0	2.7	.4	.8	0.0	0.0	0.0	0.0	2.7	.4
Light users of electricity														
Iron	99.1	96.9	95.8	97.0	98.5	97.3	97.6	103.4	105.1	101.4	104.0	114.7	135.1	107.5
Radio	96.6	92.9	87.5	98.0	97.1	91.9	94.5	112.8	108.2	104.2	111.0	126.5	140.5	114.2
Washing machine	70.1	73.5	75.0	88.0	85.3	75.7	77.6	70.9	75.5	77.8	91.0	88.2	108.1	82.3
Hot plate	44.4	29.6	34.7	44.0	48.5	48.6	40.9	45.3	30.6	36.1	46.0	52.9	51.3	42.7
Household fan	33.3	29.6	23.6	31.0	27.9	40.5	30.5	37.6	29.6	26.4	36.0	33.8	45.9	34.1
Churn	16.2	31.6	25.0	48.6	29.4	51.3	28.9	17.1	31.6	25.0	35.0	29.4	56.7	29.5
Clock	24.8	28.6	16.7	27.0	26.5	29.7	25.4	26.5	28.6	22.2	27.0	29.4	40.5	27.8
Vacuum cleaner	26.5	23.5	19.4	23.0	26.5	37.8	25.0	26.5	23.5	19.4	23.0	26.5	49.9	25.6
Toaster	24.8	17.3	19.4	24.0	22.1	37.8	23.0	24.8	17.3	19.4	26.0	23.5	48.6	24.4
Percolator	18.8	20.4	8.3	17.0	14.7	32.4	17.7	18.8	20.4	8.3	17.0	16.2	35.1	18.1
Heating Pad	10.3	10.2	13.9	18.0	11.8	37.8	14.6	11.1	11.2	16.7	18.0	13.2	48.6	16.5
Space heater	17.1	15.3	8.3	9.0	13.9	27.0	14.2	19.7	20.4	11.1	12.0	16.2	43.2	18.3
Waffle iron	10.3	8.2	5.5	13.0	13.2	16.2	10.6	10.3	8.2	5.5	13.0	13.2	18.9	10.8
Food mixer	6.0	5.1	8.3	10.0	8.8	21.6	8.5	6.8	5.1	8.3	10.0	8.8	27.0	9.1
Sewing machine	4.3	6.1	2.8	4.0	7.3	10.8	5.2	4.3	6.1	2.8	4.0	7.3	10.8	5.3
Razor	2.6	8.2	2.8	4.0	4.4	13.5	5.1	2.6	9.2	2.8	4.0	4.4	13.5	5.3
Water heater (immersion)	4.3	4.1	2.8	9.0	1.5	0.0	4.3	4.3	4.1	2.8	10.0	1.5	0.0	4.5
Broiler	1.7	1.0	1.4	1.0	4.4	13.5	2.6	1.7	1.0	1.4	1.0	4.4	13.5	2.6
Ironer	2.6	1.0	1.4	2.0	0.0	5.4	1.8	2.6	1.0	1.4	2.0	0.0	5.4	1.8
Record player	0.0	3.1	2.8	0.0	2.9	0.0	1.4	0.0	3.1	2.8	0.0	2.9	0.0	1.4
Coal stoker	.8	0.0	0.0	2.0	1.5	5.4	1.2	.8	0.0	0.0	2.0	1.5	5.4	1.2
Hot air fan	0.0	1.0	0.0	2.0	4.4	0.0	1.2	0.0	1.0	0.0	2.0	4.4	0.0	1.2
Blanket	.9	2.0	0.0	0.0	1.5	2.7	1.6	.9	2.0	0.0	0.0	1.5	2.7	1.0
Milk pasteurizer	0.0	0.0	1.4	0.0	0.0	8.1	.8	0.0	0.0	1.4	0.0	0.0	10.8	1.0
Attic exhaust fan	0.0	1.0	1.4	0.0	1.4	0.0	.6	0.0	1.0	1.4	0.0	1.5	0.0	.6
Kitchen exhaust fan	0.0	0.0	0.0	2.0	0.0	0.0	.4	0.0	0.0	0.0	2.0	0.0	0.0	.4
Window vent fan	.9	1.0	0.0	0.0	0.0	0.0	.4	.9	1.0	0.0	0.0	0.0	0.0	.4
Meat grinder	0.0	0.0	0.0	1.4	1.5	0.0	.4	0.0	0.0	0.0	1.4	1.5	0.0	.4
Dishwasher	0.0	0.0	1.4	0.0	0.0	0.0	.2	0.0	0.0	1.4	0.0	0.0	0.0	.2
Oil furnace	0.0	0.0	0.0	0.0	1.5	0.0	.2	0.0	0.0	0.0	0.0	1.5	0.0	.2
Clothes drier	0.0	0.0	0.0	0.0	0.0	2.7	.2	0.0	0.0	0.0	0.0	0.0	2.7	.2
Other	3.4	0.0	6.9	1.0	0.0	5.4	2.4	3.4	0.0	6.9	1.0	0.0	8.1	2.6
Total								689.0	686.6	618.0	734.4	761.6	1165.5	733.5

Table 18—Electric Livestock Equipment on Farms, 492 Farms Classified by Acres Operated, East Tennessee, 1949.

	Farms reporting equipment							Pieces of equipment per 100 farms						
	Under 10 acres	10-29 acres	30-49 acres	50-99 acres	100-179 acres	180 and up	Total	Under 10 acres	10-29 acres	30-49 acres	50-99 acres	100-179 acres	180 and up	Total
	Per- cent	Per- cent	Per- cent	Per- cent	Per- cent	Per- cent	Per- cent	Num- ber	Num- ber	Num- ber	Num- ber	Num- ber	Num- ber	Num- ber
Dairy Equipment														
Heavy users of electricity														
Milking machine	0.0	0.0	1.4	5.0	9.0	40.5	5.5	0.0	0.0	1.4	5.9	10.4	45.9	6.3
Milk cooler	0.0	0.0	1.4	5.0	9.0	37.8	5.3	0.0	0.0	1.4	5.0	9.0	43.2	5.7
Water heater	0.0	0.0	1.4	4.0	9.0	32.4	4.7	0.0	0.0	1.4	4.0	9.0	37.8	5.1
Light users of electricity														
Cream separator	0.0	0.0	1.4	2.0	3.0	0.0	1.0	0.0	0.0	1.4	2.0	3.0	0.0	1.0
Churn	0.0	0.0	1.4	1.0	0.0	2.7	.6	0.0	0.0	1.4	1.0	0.0	2.7	.6
Radio	0.0	0.0	0.0	0.0	1.5	0.0	.2	0.0	0.0	0.0	0.0	1.5	0.0	.2
Poultry Equipment														
Chick brooder hover	4.3	16.3	15.3	23.8	16.4	29.7	15.8	4.3	16.3	16.7	25.7	17.9	127.0	24.0
Chick brooder-battery	4.3	3.1	1.4	2.0	3.0	5.4	3.0	5.1	3.1	1.4	2.0	3.0	10.8	3.6
Egg incubator	.8	0.0	1.4	0.0	0.0	0.0	.4	0.0	0.0	0.0	2.0	0.0	0.0	.4
Water warmer	0.0	0.0	0.0	2.0										
Other Equipment														
Fence controller	.8	10.2	6.9	9.9	7.5	21.6	7.9	.8	11.2	6.9	9.9	7.5	29.7	8.7
Stock clippers	0.0	0.0	0.0	0.0	0.0	10.8	.8	0.0	0.0	0.0	0.0	0.0	13.5	1.0
Ventilating fan	0.0	0.0	0.0	0.0	0.0	2.7	.2	0.0	0.0	0.0	0.0	0.0	2.7	.2
Total								11.9	30.6	33.4	57.5	61.3	213.3	57.4
Lights														
Dairy	0.0	0.0	0.0	10.9	13.4	43.2	7.3							
Poultry	2.6	2.0	0.0	5.9	0.0	5.4	2.6							
Others	.8	3.1	1.4	10.9	9.0	21.6	6.1							

Table 19—*Electric Shop Equipment on Farms, 492 Farms, Classified by Acres Operated, East Tennessee, 1949.*

Equipment	Farms reporting equipment							Pieces of equipment per 100 farms						
	Under 10 acres	10-29 acres	30-49 acres	50-99 acres	100-179 acres	180 and up	Total	Under 10 acres	10-29 acres	30-49 acres	50-99 acres	100-179 acres	180 and up	Total
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Number	Number	Number	Number	Number	Number	Number
Tool grinders	6.8	3.1	6.9	8.9	13.4	21.6	8.5	6.8	3.1	6.9	8.9	13.4	24.3	8.7
Saw (bench including band)	1.7	1.0	6.9	4.0	6.0	2.7	3.4	2.6	1.0	8.3	4.0	6.0	2.7	3.9
Portable drill	1.7	3.1	4.2	1.0	3.0	5.4	2.6	1.7	3.1	4.2	1.0	3.0	5.4	2.6
Soldering iron	2.6	2.0	2.8	2.0	0.0	8.1	2.4	2.6	2.0	2.8	4.0	0.0	8.1	2.8
Drill press	.8	0.0	2.8	2.0	1.5	2.7	1.4	.8	0.0	2.8	2.0	1.5	2.7	1.4
Jointer	1.7	0.0	4.2	0.0	1.5	0.0	1.2	1.7	0.0	4.2	0.0	1.5	0.0	1.2
Lathe	1.7	0.0	2.8	0.0	0.0	0.0	.8	1.7	0.0	4.2	0.0	0.0	0.0	1.0
Air compressor	0.0	1.0	0.0	1.0	0.0	5.4	.8	0.0	1.0	0.0	1.0	0.0	5.4	.8
Sander	0.0	1.0	2.8	0.0	1.5	0.0	.8	0.0	1.0	2.8	0.0	1.5	0.0	.8
Planer	0.0	0.0	2.8	0.0	1.5	0.0	.6	0.0	0.0	2.8	0.0	1.5	0.0	.6
Battery charger	0.0	0.0	1.4	0.0	1.5	2.7	.6	0.0	0.0	1.4	0.0	1.5	2.7	.6
Jig saw	.8	0.0	0.0	0.0	1.5	0.0	.4	.8	0.0	0.0	0.0	1.5	0.0	.4
Concrete mixer	0.0	1.0	0.0	1.0	0.0	0.0	.4	0.0	1.0	0.0	1.0	0.0	0.0	.4
Paint sprayer	0.0	1.0	0.0	0.0	1.5	0.0	.4	0.0	1.0	0.0	0.0	1.5	0.0	.4
Others	.8	0.0	2.8	1.0	1.5	2.7	1.2	.8	0.0	2.8	1.0	1.5	2.7	1.2
Total								19.5	13.2	43.2	22.9	34.4	54.0	26.8

Table 20—*Other Miscellaneous Electrical Equipment on Farms, 492 Farms Classified by Acres Operated, East Tennessee, 1949.*

Equipment	Farms reporting equipment							Pieces of equipment per 100 farms						
	Under 10 acres	10-29 acres	30-49 acres	50-99 acres	100-179 acres	180 and up	Total	Under 10 acres	10-29 acres	30-49 acres	50-99 acres	100-179 acres	180 and up	Total
	Per- cent	Per- cent	Per- cent	Per- cent	Per- cent	Per- cent	Per- cent	Num- ber	Num- ber	Num- ber	Num- ber	Num- ber	Num- ber	Num- ber
Wood saw	0.0	0.0	1.4	0.0	1.5	0.0	.4	0.0	0.0	1.4	0.0	1.5	0.0	.4
Seed cleaner	0.0	0.0	0.0	0.0	1.5	2.7	.4	0.0	0.0	0.0	0.0	1.5	2.7	.4
Corn sheller	.8	0.0	1.4	0.0	0.0	0.0	.4	.8	0.0	1.4	0.0	0.0	0.0	.4
Total								.8	0.0	2.8	0.0	3.0	2.7	1.2

Table 21—*Electric Household Equipment in Farm Homes, 492 Farms Classified by Income, East Tennessee, 1949.*

Equipment	Farms reporting equipment				Pieces of equipment per 100 farms			
	Under \$1500	\$1500-4999	\$5000 and up	Total	Under \$1500	\$1500-4999	\$5000 and up	Total
	Percent	Percent	Percent	Percent	Number	Number	Number	Number
Heavy users of electricity								
Refrigerator	72.7	78.1	84.1	78.9	74.5	79.4	99.1	83.1
Range	14.5	28.2	53.3	32.1	14.5	28.2	57.9	33.1
Water heater (pressure type)	7.3	12.1	33.6	16.3	7.3	12.1	39.3	17.5
Freezer	1.8	2.1	13.1	4.5	1.8	2.1	15.0	4.9
Roaster	5.5	2.4	4.7	3.3	5.5	2.4	4.7	3.3
Air Conditioning	0.0	.3	.9	.4	0.0	.3	.9	.4
Light users of electricity								
Iron	98.2	97.3	98.1	97.6	103.6	100.9	129.9	107.5
Radio	92.7	93.6	98.1	94.5	101.8	107.8	143.0	114.2
Washing machine	58.2	78.0	87.0	77.6	58.2	79.7	101.9	82.3
Hot plate	38.2	39.1	47.7	40.9	38.2	40.9	50.5	42.7
Household fan	18.2	27.9	44.9	30.5	21.8	29.1	56.1	34.1
Churn	16.4	28.8	35.5	28.9	16.4	29.1	37.4	29.5
Clock	21.8	22.7	35.5	25.4	25.5	23.6	42.1	27.8
Vacuum cleaner	12.7	20.0	46.7	25.0	12.7	20.0	49.5	25.6
Toaster	16.4	18.8	39.3	23.0	16.4	19.1	44.9	24.4
Percolator	9.1	15.5	29.0	17.7	9.1	15.5	30.8	18.1
Heating Pad	5.5	10.3	32.7	14.6	5.5	10.9	39.3	16.5
Space heater	9.1	11.8	24.3	14.2	10.9	14.2	34.6	18.3
Waffle iron	7.3	7.0	23.4	10.6	7.3	7.0	24.3	10.8
Food mixer	1.8	5.5	21.5	8.5	1.8	5.7	23.4	9.1
Sewing machine	5.5	3.0	12.1	5.3	5.5	3.0	12.1	5.3
Razor	0.0	3.9	11.2	5.1	0.0	4.2	11.2	5.3
Water heater (immersion)	0.0	5.5	2.8	4.3	0.0	5.6	2.8	4.5
Broiler	0.0	1.8	6.5	2.6	0.0	1.8	6.5	2.6
Ironer	0.0	1.2	4.7	1.8	0.0	1.2	4.7	1.8
Record player	0.0	1.5	1.9	1.4	0.0	1.5	1.9	1.4
Coal stoker	0.0	.6	3.7	1.2	0.0	.6	3.7	1.2
Hot air fan	0.0	.3	4.7	1.2	0.0	.3	4.7	1.2
Blanket	0.0	.3	3.7	1.0	0.0	.3	3.7	1.0
Milk pasteurizer	1.8	0.0	2.8	.8	1.8	0.0	3.7	1.0
Attic exhaust fan	1.8	0.0	1.9	.6	1.8	0.0	1.9	.6
Kitchen exhaust fan	0.0	.6	0.0	.4	0.0	.6	0.0	.4
Window vent fan	0.0	.6	0.0	.4	0.0	.6	0.0	.4
Meat grinder	0.0	.3	.9	.4	0.0	.3	.9	.4
Dishwasher	1.8	0.0	0.0	.2	1.8	0.0	0.0	.2
Oil furnace	0.0	0.0	.9	.2	0.0	0.0	.9	.2
Clothes drier	0.0	0.0	.9	.2	0.0	0.0	.9	.2
Others	0.0	2.4	3.7	2.4	0.0	2.4	4.7	2.6
Total					543.7	649.6	1088.9	733.5

Table 22—*Electric Livestock Equipment on Farms, 492 Farms Classified by Income, East Tennessee, 1949.*

Equipment	Farms reporting equipment				Pieces of equipment per 100 farms			
	Under \$1500	\$1500-4999	\$5000 and up	Total	Under \$1500	\$1500-4999	\$5000 and up	Total
	Per-cent	Per-cent	Per-cent	Per-cent	Number	Number	Number	Number
Dairy equipment								
Heavy users of electricity								
Milking machine	0.0	1.5	20.6	5.5	0.0	1.5	24.3	6.3
Milk cooler	0.0	1.8	18.7	5.3	0.0	1.8	20.6	5.7
Water heater	0.0	.9	18.7	4.7	0.0	.9	20.6	5.1
Light users of electricity								
Cream separator	0.0	.9	1.7	1.0	0.0	.9	1.7	1.0
Churn	0.0	.6	.9	.6	0.0	.6	.9	.6
Radio	0.0	0.0	.9	.2	0.0	0.0	.9	.2
Poultry equipment								
Chick brooder-hover	7.1	12.5	30.8	15.8	7.1	13.4	65.4	24.0
Chick brooder-battery	5.4	2.1	4.7	3.0	7.1	2.1	6.5	3.6
Egg incubator	1.8	0.0	.9	.4	1.8	0.0	1.9	.6
Water warmer	0.0	.3	.9	.4	0.0	.3	.9	.4
Other equipment								
Fence controller	1.8	7.0	14.0	7.9	1.8	7.3	16.8	8.7
Stock clipper	0.0	0.0	3.7	.8	0.0	0.0	4.7	1.0
Ventilating fan	0.0	0.0	.9	.2	0.0	0.0	.9	.2
Total					16.1	28.8	166.1	57.4
Lights								
Dairy	0.0	3.3	23.4	7.3				
Poultry	0.0	1.5	7.5	2.6				
Other	0.0	4.0	15.9	6.1				

Table 23—*Electric Shop Equipment on Farms, 492 Farms Classified by Income, East Tennessee, 1949.*

Equipment	Farms reporting equipment				Pieces of equipment per 100 farms			
	Under \$1500	\$1500-4999	\$5000 and up	Total	Under \$1500	\$1500-4999	\$5000 and up	Total
	Per-cent	Per-cent	Per-cent	Per-cent	Number	Number	Number	Number
Tool grinder	3.6	5.8	19.6	8.5	3.6	5.8	20.6	8.7
Saw (bench including band)	1.8	3.0	5.6	3.4	1.8	3.3	6.5	3.9
Portable drill	1.8	1.5	6.5	2.6	1.8	1.5	6.5	2.6
Soldering iron	1.8	.9	7.5	2.4	1.8	1.5	7.5	2.8
Drill press	1.8	1.2	3.7	1.4	1.8	1.2	3.7	1.4
Jointer	0.0	.9	2.8	1.2	0.0	.9	2.8	1.2
Lathe	0.0	.9	.9	.8	0.0	1.2	.9	1.0
Air compressor	1.8	.3	1.9	.8	1.8	.3	1.9	.8
Sander	1.8	.3	1.9	.8	1.8	.3	1.9	.8
Planer	0.0	.6	.9	.6	0.0	.6	.9	.6
Battery charger	1.8	.6	0.0	.6	1.8	.6	0.0	.6
Jig saw	0.0	.6	0.0	.4	0.0	.6	0.0	.4
Concrete mixer	0.0	.3	.9	.4	0.0	.3	.9	.4
Paint sprayer	1.8	0.0	.9	.4	1.8	0.0	.9	.4
Others	1.8	0.0	4.7	1.2	1.8	0.0	4.7	1.2
Total					19.8	18.1	59.7	26.8

Table 24—Other Miscellaneous Electrical Equipment on Farms, 492 Farms Classified by Income, East Tennessee, 1949.

Equipment	Farms reporting equipment				Pieces of equipment per 100 farms			
	Under \$1500	\$1500-4999	\$5000 and up	Total	Under \$1500	\$1500-4999	\$5000 and up	Total
	Per- cent	Per- cent	Per- cent	Per- cent	Num- ber	Num- ber	Num- ber	Num- ber
Wood saw	0.6	.3	.9	.4	0.0	.3	.9	.4
Seed cleaner	0.0	.3	.9	.4	0.0	.3	.9	.4
Corn sheller	0.0	.3	.9	.4	0.0	.3	.9	.4
Total					0.0	.9	2.7	1.2

Table 25—Electric Household Equipment in Farm Homes, 492 Farms Classified by Date of Electrification, East Tennessee, 1949.

Equipment	Farms reporting equipment			Pieces of equipment per 100 farms		
	Electrified 1942 and before	Electrified 1943 and after	Total	Electrified 1942 and before	Electrified 1943 and after	Total
	Percent	Percent	Percent	Number	Number	Number
Heavy users of electricity						
Refrigerator	84.7	72.6	78.9	91.4	74.3	83.1
Range	36.5	27.4	32.1	38.8	27.0	33.1
Water heater (pressure type)	23.9	8.0	16.3	25.9	8.4	17.5
Freezer	6.7	1.5	4.5	6.7	1.5	4.5
Roaster	4.3	2.1	3.3	4.3	2.1	3.3
Air conditioning	.8	0.0	.4	.8	0.0	.4
Light users of electricity						
Iron	97.3	97.9	97.6	109.8	105.1	107.5
Radio	94.5	94.5	94.5	122.3	105.5	114.2
Washing machine	80.4	74.7	77.6	87.8	76.4	82.3
Hot plate	44.3	37.1	40.9	47.5	37.1	42.7
Household fan	36.1	24.5	30.5	42.3	25.3	34.1
Churn	32.5	24.9	28.9	33.7	24.9	29.5
Clock	29.8	20.7	25.4	32.9	22.4	27.8
Vacuum cleaner	32.9	16.5	25.0	34.1	16.5	25.6
Toaster	29.4	16.0	23.0	32.1	16.0	24.4
Percolator	23.5	11.4	17.7	24.3	11.4	18.1
Heating Pad	20.8	8.0	14.6	23.5	8.9	16.5
Space heater	18.4	9.7	14.2	23.5	12.7	18.3
Waffle iron	14.9	5.9	10.6	15.3	5.9	10.8
Food mixer	11.8	5.1	8.5	12.9	5.1	9.1
Sewing machine	7.5	2.9	5.3	7.5	2.9	5.3
Razor	6.7	3.4	5.1	6.7	3.8	5.3
Water heater (immersion)	3.5	5.1	4.3	3.9	5.1	4.5
Broiler	4.3	.8	2.6	4.3	.8	2.6
Ironer	2.7	.8	1.8	2.7	.8	1.8
Record player	1.2	1.7	1.4	1.2	1.7	1.4
Coal stoker	2.4	0.0	1.2	2.4	0.0	1.2
Hot air fan	1.6	.8	1.2	1.6	.8	1.2
Blankets	2.0	0.0	1.0	2.0	0.0	1.0
Milk pasteurizer	1.6	0.0	.8	2.0	0.0	1.0
Attic exhaust fan	.8	.4	.6	.8	.4	.6
Kitchen exhaust fan	.8	0.0	.4	.8	0.0	.4
Window vent fan	.4	.4	.4	.4	.4	.4
Meat grinder	.4	.4	.4	.4	.4	.4
Dishwasher	.4	.0	.2	.4	0.0	.2
Oil furnace	.4	0.0	.2	.4	0.0	.2
Clothes drier	2.3	2.5	2.4	2.7	2.5	2.6
Total				850.5	606.1	733.5

Table 26—*Electric Livestock Equipment and Lights on Farms, 492 Farm Classified by Date of Electrification, East Tennessee, 1949.*

Equipment	Farms reporting equipment			Pieces of equipment per 100 farms		
	Electrified 1942 and before	Electrified 1943 and after	Total	Electrified 1942 and before	Electrified 1943 and after	Total
	Percent	Percent		Number	Number	
Dairy Equipment						
Milking machine	6.3	4.6	5.5	7.1	5.5	6.3
Milk cooler	6.3	4.2	5.3	7.1	4.2	5.7
Water heater	4.7	4.6	4.7	5.5	4.6	5.1
Light users of electricity						
Cream separator	.8	1.3	1.0	.8	1.3	1.0
Churn	.8	.4	.6	.8	.4	.6
Radio	.4	0.0	.2	.4	0.0	.2
Poultry Equipment						
Chick brooder-hover	23.6	7.6	15.8	38.6	8.4	24.0
Chick brooder-battery	4.7	1.3	3.0	5.5	1.4	3.6
Egg incubator	.4	.4	.4	.4	.8	.6
Water warmer	.8	0.0	.4	.8	0.0	.4
Other Equipment						
Fence controller	9.8	5.9	7.9	11.0	6.3	8.7
Stock clipper	1.2	.4	.8	1.6	.4	1.0
Ventilating fan	.4	0.0	.2	.4	0.0	.2
Total				80.0	33.6	57.4
Lights						
Dairy	7.9	6.7	7.3			
Poultry	4.3	.8	2.6			
Other	8.3	3.8	6.1			

Table 27—*Electric Shop Equipment on Farms, 492 Farms Classified by Date of Electrification, East Tennessee, 1949.*

Equipment	Farms reporting equipment			Pieces of equipment per 100 farms		
	Electrified 1942 and before	Electrified 1943 and after	Total	Electrified 1942 and before	Electrified 1943 and after	Total
	Percent	Percent		Number	Number	
Tool grinder	13.0	3.8	8.5	13.4	3.8	8.7
Saw (bench including band)	3.9	2.9	3.4	4.7	2.9	8.9
Portable drill	3.9	1.8	2.6	3.9	1.3	2.6
Soldering iron	3.9	.8	2.4	4.7	.8	2.8
Drill press	2.4	.4	1.4	2.4	.4	1.4
Jointer	1.6	.8	1.2	1.6	.8	1.2
Lathe	1.6	—	.8	2.0	—	1.0
Air compressor	.8	.8	.8	.8	.8	.8
Sander	.8	.8	.8	.8	.8	.8
Planers	.4	.8	.6	.4	.8	.6
Battery charger	1.2	—	.6	1.2	—	.6
Jig saw	.4	.4	.4	.4	.4	.4
Concrete mixer	.4	.4	.4	.4	.4	.4
Paint sprayer	.4	.4	.4	.4	.4	.4
Others	2.0	.4	1.2	2.0	.4	1.2
Total				39.1	14.0	26.8

Table 28—*Other Miscellaneous Electrical Equipment on Farms, Farms Classified by Date of Electrification.*

Equipment	Farms reporting equipment			Pieces of equipment per 100 farms		
	Electrified 1942 and before	Electrified 1943 and after	Total	Electrified 1942 and before	Electrified 1943 and after	Total
	Percent	Percent		Number	Number	
Wood saw	.8	—	.4	.8	—	.4
Seed cleaner	.4	.4	.4	.4	.4	.4
Corn sheller	.4	.4	.4	.4	.4	.4
Total				1.6	.8	1.2

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