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HOW TO ESTIMATE THE COST OF WIRING, EQUIPMENT AND ELECTRIC SERVICE FOR THE FARMSTEAD

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SAMPLE CONTRACT FOR WIRING AND FIXTURES¹

Place

Date

To: From:
 (owner) (contractor)

We hereby propose to furnish labor and material necessary to install wiring, switches and fixtures at the farm owned by you, located The work to be done under this contract will consist of wiring outlets for lights; outlets for single or double pole switches; and outlets for 3-way switches, and furnishing hanging and connecting fixtures and convenience outlets, as follows:

Location	Outlets					Fixtures	
	Light		Switch		Convenience	Number	Price
	Ceiling	Bracket	Single	3-Way			
Porch							
Hall							
Stairs							
Living room							
Dining room							
Kitchen							
Furnace room							
Basement							
Storeroom							
Upper hall							
Bedroom							
Bedroom							
Bedroom							
Bath							
Attic							
.....							
.....							

Type of service and distribution center

The total price of the work, complete as specified, is dollars (\$.....), made up as follows:

- Wiring to outlets only \$.....
- Switches, plates, bodies, cords, etc. \$.....
- Fixtures \$.....
- Additional for \$.....
- Total \$.....

and we agree to accept payment of said sum of \$....., payable as follows:

Accepted: Signed:
 (owner) (contractor)

¹ Adapted from University of Illinois multigraphed Extension Circular, A. Eng-56, "Farm Wiring."

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**HOW TO ESTIMATE THE COST OF WIRING, EQUIPMENT
AND ELECTRIC SERVICE FOR THE
FARMSTEAD**

By **JAMES B. KELLEY** and **EARL G. WELCH**

The cost of outlets for lighting and small appliances may vary in different localities from \$1.50 to \$6.00 each, depending upon kind of outlet, materials used, type of construction of the building and cost of labor and materials. The following prices for wiring may be used as a basis for estimating the cost of an installation.

Service entrance and distribution center	\$10.00 to \$25.00
House light, switch and convenience outlets, each	2.50
Outlet for water heater	5.00
Wire and outlet for range	15.00
Yard pole (25-foot length)	10.00
Inter-building wiring, per foot	7 cents
Outlets for farm motors, each	5.00 to \$8.00
Service line extension beyond limit allowed in line construction contract	10 to 20 cents per foot

There are wide differences in type, size and cost of lighting fixtures and electric appliances (see Table 1).

An idea of the cost of adequately wiring and equipping a house with lighting fixtures and a few appliances may be formed by studying the data given in Table 3. The 29 outlets comprise 11 ceiling and wall lighting outlets, 8 convenience outlets, 9 wall switches, and 1 heavy-duty outlet for range. The costs are based on medium-priced lighting fixtures and appliances.

CONTRACT FOR WIRING

If the work is to be done by a contractor, a written contract should be signed by the contractor and owner. If the work must pass inspection based on a code, this should be so stated in the contract and provision should be made for withholding a stipulated percentage of the price of the work until the contractor presents the owner with a certificate of approval signed by an approved inspector. Usually 60 percent of the price is withheld. The contract should contain a definite agreement concerning the installation of the service entrance and fixtures in addition to outlets and switches. A suggested form of contract is shown on page 2 this circular.

HOW TO ESTIMATE THE COST OF ELECTRICAL EQUIPMENT

Table 1 contains a list of electrical appliances for the farm home, with approximate price and kilowatt-hour consumption of each. Table 2 contains a list of electric equipment used on the farm outside the home and the horsepower requirement and current consumption of each, per unit of capacity. This information should be helpful in considering the purchase of such equipment. Altho the amount of electricity required for operating any machine varies with the conditions under which it is operated, the prospective purchaser may estimate the approximate cost of current for operating each device by multiplying the kilowatt-hour consumption figures given by the local rate charged for electricity.

HOW TO ESTIMATE THE COST OF USING ELECTRICAL POWER

The kilowatt hour (kw. hr.) is the unit of measure by which electricity is purchased just as a bushel is the unit for measuring grain. For example, a 100-watt light bulb operating for 10 hours uses a kilowatt hour of electrical energy. The number of hours an appliance may operate on 1 kilowatt hour of current is determined by dividing the number of watts required to operate it into 1000. A 500-watt flatiron used continuously will operate 2 hours ($1000 \div 500 = 2$) on 1 kilowatt of electrical energy. Electricity used is recorded by an instrument known as a watt-hour meter. To estimate the cost of using electricity, proceed as follows:

1. Make a list of the appliances to be used and the amount of current used by each. The probable consumption, in kilowatt hours, of each appliance may be taken from Tables 1 and 2.

Appliances and current required.

Lights, per month	25 kw. hrs.
Iron, per month	6 kw. hrs.
Radio, per month	7 kw. hrs.
Washing machine, per month	3 kw. hrs.
Shallow-well pump, per month	9 kw. hrs.
Refrigerator, per month	50 kw. hrs.
Range, per month	150 kw. hrs.
Feed grinder, per 100 lbs.	2 kw. hrs.
Milk cooler, per 10 gals.	1 kw. hr.

2. Set down the rate schedule taken from your contract for electric service. The schedule below is assumed merely for illustration.

Rate schedule from contract.

1st 20 kw. hrs. at 10 cts. per kw. hr.
Next 30 kw. hrs. at 5 cts. per kw. hr.
Next 50 kw. hrs. at 3 cts. per kw. hr.
Next 100 kw. hrs. at 2.5 cts. per kw. hr.
All over 200 kw. hrs. at 2 cts. per kw. hr.

Many contracts for electric service provide special "off peak load" rates for storage-type water heaters. The rate is about one cent per kilowatt hour. The "off peak load" period is at night when the demand for current for other purposes is small.

3. Prepare a table of the appliances, rate schedule, and current consumption of each in the following form. Then make the cost calculations as in the following table which is based on the assumed rates.

Estimate of the monthly cost of current.

Appliance	Cur- rent used	20	30	50	100	Over	Cost	Sub-total
		kw. hrs. @.10	kw. hrs. @.05	kw. hrs. @.03	kw. hrs. @.025	200 kw. hrs. @.02		
		kw. hr.	kw. hr.	kw. hr.	kw. hr.	kw. hr.		
Lights	25	20	5				\$2.25	\$ 2.25
Radio	7		7				.35	
Washing machine	3		3				.15	
Flatiron	6		6				.30	
Shallow-well pump, 6000 gals.	9		9				.45	3.50
Refrigerator	50			50			1.50	5.00
Feed grinder, 1 ton	40				40		1.00	
Milk cooler, 600 gals.	60				60		1.50	7.50
Range	150					150	3.00	10.50
Total	350					Total	10.50	

From the table, "Estimate of the monthly cost of current," note that the monthly bill for any farm depends upon the rates and the total amount of electricity used. The average cost of electricity per kilowatt hour decreases as the quantity used increases. For example, if the customer uses only 20 kilowatt hours for lights, the rate is 10 cents per kw. hr. If lights, an iron, a radio, a washing machine and shallow-well pump are operated, the total consumption of 50 kilowatt hours for the month costs \$3.50 and the average rate is 7 cents per kw. hr. By adding a refrigerator, the total consumption of current is increased to 100 kw. hrs. and the monthly bill to \$5.00, but the average rate per kilowatt hour is only 5 cents. A feed grinder and milk cooler may consume 100 kilowatt hours and increase the bill to \$7.50 for a total of 200 kilowatt hours, but the average cost is decreased to $3\frac{3}{4}$ cents per kilowatt hour. If a range is added, the total amount of current consumed in a month is 350 kilowatt hours and the total bill is \$10.50, but the average cost of current is only 3 cents per kilowatt hour.

Table 1. Approximate purchase prices and current consumption in kilowatt hours of electrical appliances for the farm home.

Appliance or machine	Approximate price range	Approximate consumption in kilowatt-hours
Dishwasher.....	\$160.00 to \$325.00	2¼ per month
Fan.....	3.50 to 32.00	1 for each 8 to 10 hours
Iron.....	3.00 to 9.00	1 per person per month
Ironing machine.....	50.00 to 95.00	8 to 10 per month per family
Lighting home.....		25 per month (including small household appliances)
Oil furnace (control).....		200 to 500 per year
Radio—All electric.....	15.00 to 275.00	3½ to 12 (average 8) per month
Battery charger		3½ to 5 per month
Range.....	60.00 to 325.00	30 per person per month
Refrigerator	85.00 to 350.00	30 to 50 per month
Sewing machine.....	35.00 to 100.00	1 or less per month
Clock	3.00 up	2 per month
Vacuum cleaner.....	15.50 to 65.00	1 to 3 per month
Washing machine.....	50.00 to 125.00	½ per person per month
Water heater.....	55.00 to 331.00	150 to 600 per month
Water supply.....	40.00 to 125.00	
Shallow well or cistern.....		1 to 1.5 per 1000 gallons pumped
Deep well.....		1.5 to 2.0 per 1000 gallons pumped.

NOTE: Data in Tables 1 and 2 were obtained from the following sources:

"Rural Electrification," by J. P. Schaenzer.

"Description Data 3190," Westinghouse Electric and Manufacturing Company.

"The Cost of Operating Electric Farm and Home Equipment," General Electric Co.

"Wired Help For Farm and Home," Westinghouse Electric and Manufacturing Co.

"Electricity On The Farm," C. R. E. A. Bul. Vol. VII, No. 3.

Table 2. Power requirements and current consumption in kilowatt hours, of electrical equipment used on the farm.

Appliance or machine	Motor horsepower			Approximate consumption in kilowatt hours
	Small-est	Larg-est	Size most used	
Apple grader	1/4	1/2	1/4	1/2 to 1 1/2 per 100 bu.
Bottle washer	1/8	3/4	1/4	.5 per 1000 bottles
Bottling and capping machine.....	1/6	3/4	1/4	1 per 1000 bottles
Butter churn.....	1/8	3/4	1/4	1 to 2 per 100 lbs. butter
Brooder	—	—	—	1/2 per 6 weeks per chick
Cider mill	—	—	—	1 per 10 bushels
Corn husker and shredder.....	2	5	5	5 per ton
Corn sheller	1/4	5	1/4	1 per 300 lbs. shelled
Concrete mixer.....	1/4	10	1/4 and 5	5 per 5 cubic yards
Cream separator.....	1/10	1/4	1/8	.5 per 1000 lbs., milk
Dairy water heater.....	—	—	—	15 to 35 per 100 gallons
Drill press.....	1/8	1/2	1/4	5—Average per
Emery wheel.....	1/8	1	1/4	month for the
Forge blower.....	1/10	1/4	1/8	farm shop
Ensilage cutter.....	5	15	5	.8 to 1.5 per ton
Fanning mill.....	1/4	1/2	1/4	1.5 per 100 bushels
Feed grinder.....	1	7 1/2	5	.1 to 3 per 100 pounds
Feed mixer.....	3	7 1/2	5	1 per 500 pounds
Grain elevator.....	1/2	5	3 & 5	2 to 8 per 1000 bushels
Hay baler.....	3	15	7 1/2	2 to 4 per ton
Hay hoist.....	3	10	5	.4 per ton
Incubator (Small).....	—	—	—	150 to 300 per 1000 eggs
Irrigation pump (Surface).....	—	—	—	2 to 4 per acre-ft. per ft. of lift
Lighting entire farm.....	—	—	—	25 to 30 per month
Milk cooler.....	—	—	—	25 to 30 per mo. per 10 gals. per day
Milking machine (Portable).....	1/6	1/4	1/6	1 1/2 per cow per month
Milking machine (Pipe Line).....	3/4	3	1	2 to 3 per cow per month
Paint sprayer.....	—	—	—	1 per 250 square feet
Potato grader.....	1/2	1	1/2	1 per 600 to 700 lbs.
Refrigeration (Dairy).....	1/4	15	1	25 per mo. to 10 gal. of milk per day
Root cutter.....	1/4	5	1	.2 per 100 pounds
Seed corn tester.....	—	—	—	2 per bushel tested
Sheep shears.....	1/2 hp. per clipper	—	—	1 1/2 to 2 per 100 sheep
Sausage grinder.....	1/4	1/2	1/4	4 per 100 pounds
Soil heating (Hotbed).....	—	—	—	1/2 to 1 1/2 per day per sash (3' x 6')
Soil sterilizing.....	—	—	—	1 to 1 1/2 per cubic ft.
Stationary sprayer.....	1 1/2	25	7 1/2	70 per acre per season
Thresher.....	—	—	10	1/3 per 100 lbs., grain
Ultra-violet rays for cows (S-1).....	—	—	—	25 to 35 per year per cow
Ultra-violet rays for hens (S-1).....	—	—	—	1/2 to 1 per year per bird
Ultra-violet rays for chicks (CX).....	—	—	—	1/5 to 1/2 per brood per chick
Washing machine.....	1/6	1/4	1/4	2 per family per mo. (1/2 per person)
Water supply, all farm uses.....	1/6	5	1/2	1 to 3 per 1000 gals. of water
Wood saw.....	5 to 7 1/2	—	—	1 to 2 1/2 per cord

Table 3. Method of calculating the cost of the wiring system, lights, fixtures and appliances for an adequately wired house.

Wiring system		
Service entrance and distribution center		\$10-25.00
28 Outlets at \$2.50, for switches and receptacles for lights and small appliances		70.00
1 Heavy-duty outlet and wiring, for range		15.00
Light fixtures, installed		
Light bulbs	16 @ 15c	\$ 2.40
Porches	2 fixtures	1.50
Kitchen	1 ceiling fixture	1.50
Living room	1 ceiling fixture	5.00
Living room	1 floor lamp	5.00
Bedrooms	2 ceiling fixtures	3.00
Bathroom	1 wall fixture	1.50
Hall and stairway	2 ceiling fixtures	2.30
Cellar	2 ceiling fixtures	1.50
Appliances		
1 Flatiron		\$ 5.00
1 Washing machine		50.00
1 Vacuum cleaner		25.00
1 Refrigerator (7 cubic feet)		150.00
1 Shallow-well pump (not installed)		45.00
1 Radio		20.00
1 Range		150.00

Formerly No. 14 wire was used almost exclusively for residence branch circuits but owing to the increasing variety of electrical appliances used in the home, No. 12 wire is recommended. Ranges, water heaters, and some motors require larger wires, the sizes of which must be determined. For further information consult your county or home agent, or write to the Extension Division, College of Agriculture, Lexington, Kentucky.