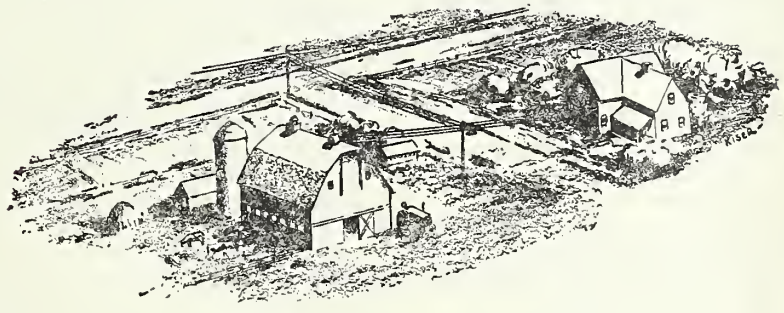
Rural Electrification

AFTER THE WAR



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UNITED STATES DEPARTMENT OF AGRICULTURE

INTERBUREAU COMMITTEE ON POST-WAR PROGRAMS

". . . I outline the fundamental principles which must underlie the expansion of rural electrification:

First: Rural homes need electricity as much—if not more—than city homes. We can't have a decent standard of rural living without the things which electricity provides for the farm homes.

Second: We must look upon the furnishing of electricity to farmers as an opportunity for service to agriculture rather than a means for making a profit.

Third: REA cooperatives are the best means of getting electric service to the maximum number of rural people at the earliest date. That is true because REA cooperatives—the same as all true cooperatives—are organized for service and not for profit."

Claude R. Wickard

CLAUDE R. WICKARD,
Secretary of Agriculture.

—from an address delivered on September 20, 1944, at Neillsville, Wis

In Brief

This publication tells what progress has been made in rural electrification so far, what the post-war objectives should be, why an accelerated post-war program is desirable and important, what it should be possible to accomplish in 5 years.

Some of the statistics and estimates relate to a 5-year program which could be accomplished with both private and Government financing; some relate only to a proposed 3-year REA program. In reading and using this publication, care should be taken to distinguish between these two sets of estimates.

It shows that little more than 40 percent of our farms are electrified and that 3,540,000 farms and about 2,800,000 other rural dwellings are still without central-station electric service.

It sets as post-war objectives (1) electric service to all rural people, (2) full use of electricity on the farmstead, (3) its full use for rural welfare, and (4) its use in developing local rural industries.

It estimates that a vigorous 5-year program by private utilities, cooperatives and public agencies, can provide service to 3,655,000 additional rural families and will require about 2¾ million man-years of employment. This will involve the expenditure of about 1 billion dollars for line construction and expenditures by old and new rural consumers, amounting to about 750 million dollars for wiring of premises, about 700 million dollars for plumbing installations, and about 3 billion dollars for electric appliance and equipment purchases, or a total expenditure of about 5½ billion dollars.

Such a program will be a tremendous stimulus to private employment. Since it is projected as a self-liquidating program, it means no burden to the taxpayers and will correspondingly reduce the need of tax-supported public-works programs during the reconversion and readjustment period. It will bring rural electrification in the United States on a par with that of other advanced countries; it will help to make farm life pleasanter and more attractive, farming easier and more profitable; and it will create a better social, economic, and cultural environment for our rural population generally.

But the job can be done only if the principle of area coverage is carried out in this program. Otherwise there will remain many unserved and unservable pockets because the cost of bringing electricity to these sparsely settled communities separately would be prohibitive.

The proposed REA 3-year program contemplates line construction by REA-financed cooperatives to bring service to about 1,300,000 additional rural families. It is estimated that such a program will require about $579,000,000 of REA loans.

The last part of this publication emphasizes the need of cooperation by various groups and agencies, and particularly by the rural people themselves, if the job is to be done quickly and effectively.

WASHINGTON, D. C. Issued FEBRUARY 1945

CONTENTS

Part 1

Part 2

Part 3

Part 4

Part 5

Part 6

Part 7

Part 1

PROGRESS AND PRESENT STATUS OF RURAL ELECTRIFICATION[1]

Farm electrification advanced very slowly during the 53-year period from 1882, when the first central generating system went into service, to 1935, when the Rural Electrification Administration (REA) was created. A few farmers were connected to central-station power prior to World War I, and the early twenties saw a short-lived spurt in which progress made in electrical engineering was reflected by a small increase in the number of farms served. As shown in table 1, however, only 10.9 percent of all farms in the United States had received central-station electric service by 1935. Farmers and farm organizations, chafing at the slow rate of progress increased their demands for Government action. One result was the establishment of REA with an action program primarily to make service available to those farm people who were without electric service, and to promote related agricultural community action.

TABLE 1.—*Farms in the United States with central-station electric service, 1925–44*

Year	Farms electrified as of Jan. 1[1]		Index of farm electrification growth 1936=100
	Number	Percent of total farms	
1925	204,780	3.2	26.0
1930	576,168	9.0	73.0
1935	743,954	10.9	94.3
1936	788,795	11.6	100.0
1937	1,042,924	15.3	132.2
1938	1,241,505	18.2	157.4
1939	1,406,579	20.6	178.3
1940	1,786,000	26.2	226.4
1941	2,069,759	33.9	262.4
1942	2,352,603	38.6	298.3
1943	2,486,230	40.8	315.2
1944	2,557,247	41.9	324.0

[1] Data furnished by the Edison Electric Institute.

FARM ELECTRIFICATION

The census of 1940 reported 6,097,000 farms in the United States, of which 1,853,000 were receiving central-station electricity. Since the census enumeration it is estimated that 704,000 farms have been electrified, raising the total number to 2,557,000, as of January 1, 1944 (table 2).

ELECTRIFICATION OF RURAL DWELLINGS

According to the 1940 census, there were 15,709,000 rural dwellings. Of this number, 7,642,000 were classified as farm, and 8,057,000 as nonfarm dwelling units. As shown in table 2, a total of 2,351,000 rural farm dwellings and 6,185,089 rural nonfarm dwellings were reported to have electric service in 1940.

The difference in the census figures as between farms and rural farm dwellings is explained by the definition of rural dwelling units used in the census[2] classifications: ". . . the living quarters occupied by, or intended for occupancy by, one household . . . Rural-nonfarm dwelling units are those located outside the boundaries of urban places but not on farms . . . Rural-farm dwelling units are those located on farms outside urban places." Since there are sometimes several dwelling units on one farm, the number of farm dwellings is greater than the number of farms.

UNELECTRIFIED FARMS AND RURAL HOMES

As indicated in table 2, 829,000 farms and rural homes have been connected to central-station power lines, by all agencies, public and private, since the 1940 census was taken. This leaves a total of 6,344,000 rural farm and rural nonfarm dwelling units without electric service. About 1 million of these appear to be within the service area of existing urban power systems. Figure 1 indicates by counties where these unelectrified farms and rural homes are located. To bring electricity to them is a challenging job.

TABLE 2.—*Status of the electrification of farms and rural dwellings in the United States, Jan. 1, 1944*

STATUS OF FARM ELECTRIFICATION	
Total farms (U. S. census 1940)	6,097,000
Farms electrified as of 1940 (U. S. census)	1,853,000
Estimate of farms electrified from 1940 to 1944	704,000
Farms electrified as of Jan. 1, 1944	2,557,000
Farms unelectrified as of Jan. 1, 1944	3,540,000
STATUS OF THE ELECTRIFICATION OF RURAL DWELLINGS	
All rural dwelling units as of 1940 (U. S. census):	
Rural farm	7,642,000
Rural nonfarm	8,067,000
Grand total rural dwellings	15,709,000
Rural dwellings electrified as of 1940 (U. S. census):	
Rural farm	2,351,000
Rural nonfarm	6,185,000
Rural dwellings electrified from 1940–1944:	
Rural farm	704,000
Rural nonfarm	125,000
Total electrified rural dwellings Jan. 1, 1944	9,365,000
Rural dwellings unelectrified Jan. 1, 1944	6,344,000

[1] This publication was prepared under the direction of James Salisbury, Jr., national activity leader on rural electrification for the Department of Agriculture Interbureau Committee on Post-war Programs. It is the work of the Post-war Planning Committee of the Rural Electrification Administration, with individual contributions by the various members; Acting Administrator William J. Neal, Deputy Administrator Vincent D. Nicholson, John W. Asher, Jr., Robert T. Beall, Walter B. Bigelow, Arthur W. Gerth, George J. Long, H. S. Person, Percy H. Sachs, James Salisbury, Jr., J. P. Schaenzer, and L. P. Slattery.

[2] See U. S. Bur. of Census, 16th Census, 1940, Housing. Vol. 2, General Characteristics, pt 1, Summary, p. 2. 1943.

THE REA PROGRAM

REA was created by Executive order of the President on May 11, 1935, and was given permanent status by the Congress through enactment of the Rural Electrification Act of 1936. It was transferred to the Department of Agriculture on July 1, 1939. The act empowers REA to make self-liquidating loans to qualified organizations, with preference to nonprofit and cooperative organizations, for the construction of power facilities to persons in rural areas without central-station service, and for financing the purchase of electric facilities and equipment by rural consumers.

The stimulating effect of this dynamic Federal program is reflected in table 1. Between 1935 and 1944, the number of farms electrified increased from 740,000 to 2,557,000. No figures are available which show the growth during this period in the number of rural nonfarm establishments electrified, but the indications are that nonfarm rural service kept pace.

Up to June 30, 1944, REA has approved loans to 887 borrowers, totaling $498,811,446, of which $387,630,670 had been advanced; 815 borrowers had 398,000 miles of power lines in service on that date, bringing electricity to 1,152,031 consumers, of whom 889,051 were farmers. The location of REA-financed systems is shown in figure 2 (page 8).

Part 2

OBJECTIVES OF A POST-WAR PROGRAM

A rural electrification program for the post-war period must be geared to meet the following objectives if it is to bring the greatest possible benefits to our rural population and to the Nation as a whole.

ELECTRIC SERVICE TO ALL RURAL PEOPLE

Central-station electric service at low-cost nondiscriminatory rates should be extended to all rural communities and farms on an area-wide basis as rapidly as materials and manpower will permit.

FULL APPLICATION OF ELECTRICITY TO FARM PRODUCTION AND FARM-FAMILY LIVING

Relatively few farmers have so far learned to put electricity to the greatest possible use on the farmstead and in the farm home. New and old farm users of electric service will require help and guidance in its full application. Electro-agriculture is a key to farming as a successful business in the post-war world. Production and conservation of crops and livestock depend more and more on electrical aids. And the effective application of electricity to the many possible household uses has been recognized as an essential to farm-family health and welfare.

FULL USE FOR RURAL COMMUNITIES

Rural communities are threatened by social and cultural stagnation unless their physical facilities are modernized to meet the needs of today and tomorrow. Electricity is one of the most important factors in that process. It is basic to the effective use of rural schools, churches and community centers, to the establishment of community health clinics, service enterprises, and entertainment and recreational facilities. Every rural community should be encouraged and enabled to utilize electricity for all possible improvements. One of the possibilities is the use of rural power lines for local and long-distance telephone service.

FULL RURAL INDUSTRIAL USE

There are still many untapped or inadequately utilized natural resources in rural areas. There is also need of rural processing industries close to the source of production. And after the war there may again be a seasonal, if not year-round, oversupply of manpower in many rural areas. The welfare of the Nation demands that these rural resources and needs be not neglected. Electricity provides a key to their development. Therefore, the development of every type of suitable rural industry in every electrified rural area should be considered part of a Nation-wide rural electrification program. To be of maximum service to farm people, such developments should be cooperatively owned and controlled, wherever possible.

Part 3

REASONS FOR AN ACCELERATED PROGRAM

There are a number of important reasons why a vigorous rural electrification program should be launched as rapidly as the war situation will permit. Some of them are implied in the preceding statement of objectives.

STIMULATION OF PRIVATE EMPLOYMENT

The shifting from a war to a peace economy will release increasing numbers of men and women from war production and from the armed forces. If we want to avoid large-scale unemployment, we must create as many job opportunities as possible. The construction of rural power lines, the installation of wiring and plumbing, and the purchase of electric farm and household equipment by new and old rural consumers will necessitate industrial production involving nearly 3 million man-years of labor. Such a program will therefore be extremely helpful in stimulating private employment.

A SELF-LIQUIDATING PROGRAM

The 5-year and 3-year programs outlined in this statement consider only self-liquidating developments. They will therefore not be a burden on the taxpayers of the Nation. On the contrary, they will correspondingly reduce the need of tax-supported public works employment. Because of these facts, their acceleration during the reconversion period is particularly desirable.

UNITED STATES STILL BEHIND IN RURAL ELECTRIFICATION

In 1935, when less than 11 percent of American farms had electric high-line service, farm electrification had reached 85 percent in Denmark, 90 percent in Germany, 95 percent in France, and practically 100 percent in Holland. Even today, with slightly more than 40 percent of our farms electrified, we are still far behind these and other countries in that respect. The excuse that the lower population density in many of our rural areas makes the extension of electric service to them not feasible is no longer valid. The REA program has demonstrated that even thinly populated rural areas can be served by the application of the area-coverage principle and by means of nonprofit, farmer-owned and farmer-controlled cooperatives organized for the specific purpose of providing electric service to their members.

IMPORTANCE OF ELECTRICITY TO FARM PRODUCTION AND MANAGEMENT

Agricultural leaders and educators are fully aware that electricity is the greatest single factor in bringing farming to a degree of efficiency in keeping with the advances made in industrial production and management. If the family-size farm is to survive and to hold its own in competition with corporation farming and with post-war farming in other countries, it must be enabled to take full advantage of electricity in the production and preservation of crops and in livestock management.

There is insufficient space here to enumerate the many practical uses of electricity for saving time and labor, for reducing farm operating costs and increasing farm income. It provides light and heat and power for many purposes, including refrigeration and the pumping of water. One kwh. will pump 1,000 gallons of water from the average farm well. It will milk 30 cows, heat 5 gallons of water, grind 200 bushels of grain, run a tool grinder for 4 hours, shell 30 bushels of corn, cool 10 gallons of milk, or cut 1 ton of ensilage and elevate it into a 30-foot silo. The importance of electricity to efficient farming became so obvious early in the war that the War Production Board felt justified in releasing materials highly important to war needs for the electrification of more farms during the war.

NEEDED FOR BETTER FARM-FAMILY LIVING

Electricity on the farm makes possible the use of many modern conveniences which eliminate drudgery, save time, provide added comforts, and increase the well-being of the farm family. Running water in the house brings better sanitation and saves many steps. Refrigeration preserves food and makes better nutrition possible. The electric washer and the electric iron make the family laundry less of a chore. The radio keeps the farm family in touch with the rest of the Nation and the world. Eyesight is preserved by good lighting. The people now on farms will no longer be satisfied to go without electricity in the farm home. And few of the many rural young men and women now in the armed forces or in war factories will want to go back to the farm unless there is at least an early prospect of getting electricity with its resulting modern conveniences. (See fig. 1.)

IMPROVEMENT OF RURAL COMMUNITY FACILITIES AND SERVICES

To the extent that social and economic progress of rural communities lags behind urban-industrial progress, the welfare of the Nation as a whole is impaired. In the case of the unelectrified rural community this lag is accentuated.

Of course, more than one single factor or group of factors may be responsible for the lag, which in turn, invites a run-down-at-the-heels condition. It is ap-

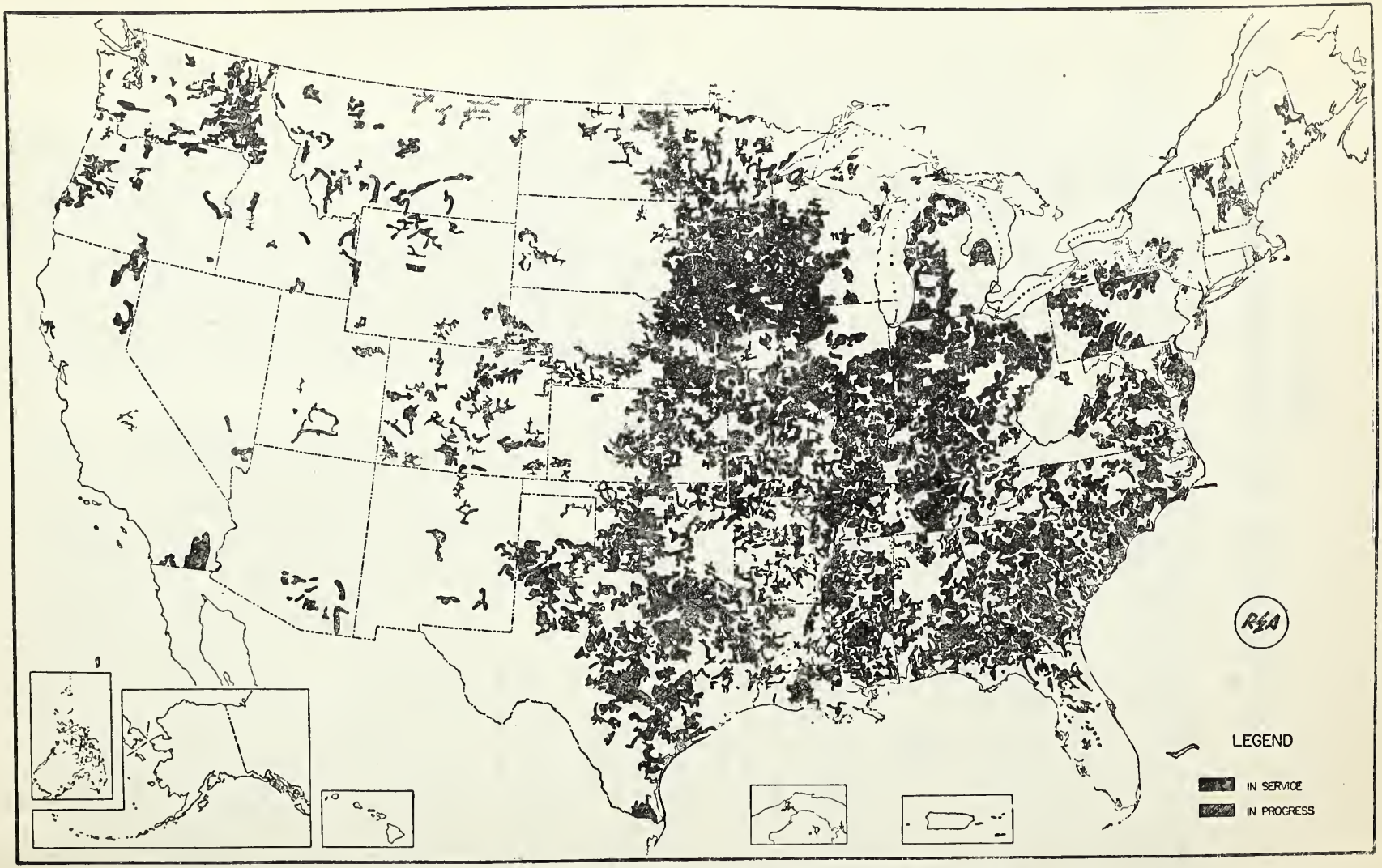

FIGURE 1.—Rural Electrification Administration financed systems as of June 30, 1944.

parent, however, that as their lack of modern facilities became more conspicuous by comparison with nearby urban developments, rural communities offered less attraction to their people.

If rural communities are to retain (or reacquire) the sense of civic responsibility essential to the maintenance of democracy, those rural communities must be revitalized by getting the modern tools necessary to living in the modern world. Rural leaders recognize that many of the important implements for bringing about and maintaining higher community standards are dependent on the wide and efficient use of low-cost electric power. Schools, churches, community centers, health clinics, service enterprises, recreational facilities, automotive and farm-implement repair shops, cold-storage locker plants—all of these need electricity to bring the maximum benefit to rural areas and communities. Such improvements speed up the modernization of rural United States. A substantial expansion of past progress is a legitimate part of a well-rounded program of national rural electrification.

One important need is for rural local and long-distance telephone service. There are now fewer telephones in rural areas than 20 years ago. Many now existing are limited exclusively to local service. Technical investigation carried on in the pre-war period shows that telephone communication can be made available over the rural power lines; and by tying in with existing telephone systems, intercommunication can be arranged with all parts of the country.

DEVELOPMENT OF RURAL INDUSTRIES

Development of new rural industries and industrial decentralization constitute an almost untouched field which holds promise of important public values. The TVA has successfully demonstrated the peacetime as well as wartime benefits of such developments. Power developments of recent years have contributed immeasurably to the production of war materials and equipment. Widespread availability of ample low-cost electric power makes possible decentralization of industry. REA experience shows that with the availability of reasonably priced power comes a substantial increase in the number of small rural industries. Farseeing persons visualize these sound developments as a key to greater rural prosperity. The dangers of the predominantly one-crop agriculture were revealed in the recent depression which found millions of farm families unprepared to make effective use of their potential resources.

Complete rural self-sufficiency is incompatible with the standard of living to which rural, as well as urban, people are entitled. But the coming of electric power to rural areas offers untold opportunities not only for increasing self-reliance on the farm, but also for developing industrial activities in the rural community catering to local needs and utilizing local resources.

Development of rural industries may open a new frontier to the men who return from the armed services. This is an opportunity for agriculture and the rural area to contribute again to the progress of the Nation. Part-time, farm-rural industrial employment holds promise of contributing to stability of income, maintenance of high living standards, and promotion of rural security.

The natural and human resources of most rural communities are still being exploited, rather than conserved. Objectives of a national rural electrification program should therefore include the development of rural industries dependent on the availability of low-cost electric power, to the end that rural communities may employ their natural and potential wealth for building a more stable rural life.

IMPORTANCE OF PROPER LAND USE.

Electric power and productive electrical farm equipment are becoming increasingly important in facilitating desirable adjustment in land use. Area-wide electrification makes possible alternative uses of land. Low-cost power permits using land according to its capabilities. One of the immediate effects of electric power on land use practices is diversification of farm enterprises. The kinds of electrical equipment purchased for the farm in various parts of the country indicate this.

South and Southwest farms have added poultry and dairy production, along with new crops such as sweetpotatoes and peanuts. It is possible to grow sweetpotatoes on a commercial scale profitably in certain areas because electricity permits proper curing and storage without the risks of loss from spoilage.

Another change in land use made possible by low-cost electricity has been irrigation in areas where adequate supplies of underground water permit. Some parts of the Southwest have been enabled to shift from predominant cash-grain farming to specialty crops or a combination of livestock and crops.

In some parts of the country dairying has become a major farm enterprise where cash-crop production once predominated. War conditions have undoubtedly accelerated this shift, but electrical dairy equipment, including the milker and milk cooler, has also been a factor. Truck farming has become profitable in a number of areas as a result of the availability of electric power for supplying water and operating canning, dehydrating, freezing, and other processing equipment. Farm forestry in some areas can also be made more profitable by the application of low-cost power. Combinations of poultry, dairy, or livestock production with cash-crop production, especially on the small family-size farms of the Nation, have nearly always accompanied farm electrification.

Although a rural power line does not determine the pattern, it does greatly influence proper land use. It is already apparent that the post-war demand for rural residential and farm properties from veterans and others will far exceed the supply of available good farm land. If this demand is to be satisfied without the prospect of the creation of substandard living conditions, fullest advantage must be taken of electricity in the development of proper land use particularly in less prosperous rural areas.

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Part 4

OTHER FACTORS AFFECTING THE PROGRAM

In the preceding parts of this publication, the objectives and the need of an accelerated rural electrification program have been indicated. But although its desirability is beyond doubt, the question may properly be asked whether, and to what extent, such a program can be made practicable on a self-liquidating basis. Fortunately, REA's experience over the past 9 years provides the basic answers to this question. The feasibility of the program depends primarily on the few major factors considered below.

COST OF OBTAINING SERVICE

The average farmer cannot afford electric service if he has to lay out a considerable sum of money to get the line to his farm and if he must agree to a high minimum service guarantee and to high service rates. REA has demonstrated in nearly every state that electric service on a self-liquidating basis can be brought to farmers without such inequitable requirements. The example set by REA-financed cooperative power systems has resulted in a lowering of requirements by most power companies supplying rural service.

SERVICE CONTINUITY

As farmers install more and more electrical equipment in their homes and especially in their farmyards and outbuildings, it becomes essential that the supply of energy to operate that equipment shall be as nearly continuous as possible. The areas remaining without electric service are likely to be those with progressively poorer roads and communication facilities, making maintenance work more difficult. Much emphasis must be placed, therefore, on proper engineering design. Sturdiness and dependability are not inconsistent with low cost; the lines built in accordance with REA specifications cost about half the average cost of rural power lines a decade ago. The more liberal loan terms available under recent amendments of the basic Federal rural electrification law should eliminate any need for sacrificing continuity for initial cheapness. Also, recent engineering advances promise continuing progress in this respect.

THE PRINCIPLE OF AREA COVERAGE

The program outlined in Part 5 is based on the assumption that rural electrification will be carried out as far as possible on an area-coverage plan. In fact, development on an area-wide plan offers the only assurance that virtually all rural homes and other rural establishments, such as schools and churches, can obtain electric service at reasonable rates without the need of subsidies or grants-in-aid. REA borrowers in all regions have proved this plan in operation.

The use of the complete-coverage principle assures availability of electric service to rural consumers within an area. Ignoring this principle results in the perpetuation of unserved sections.

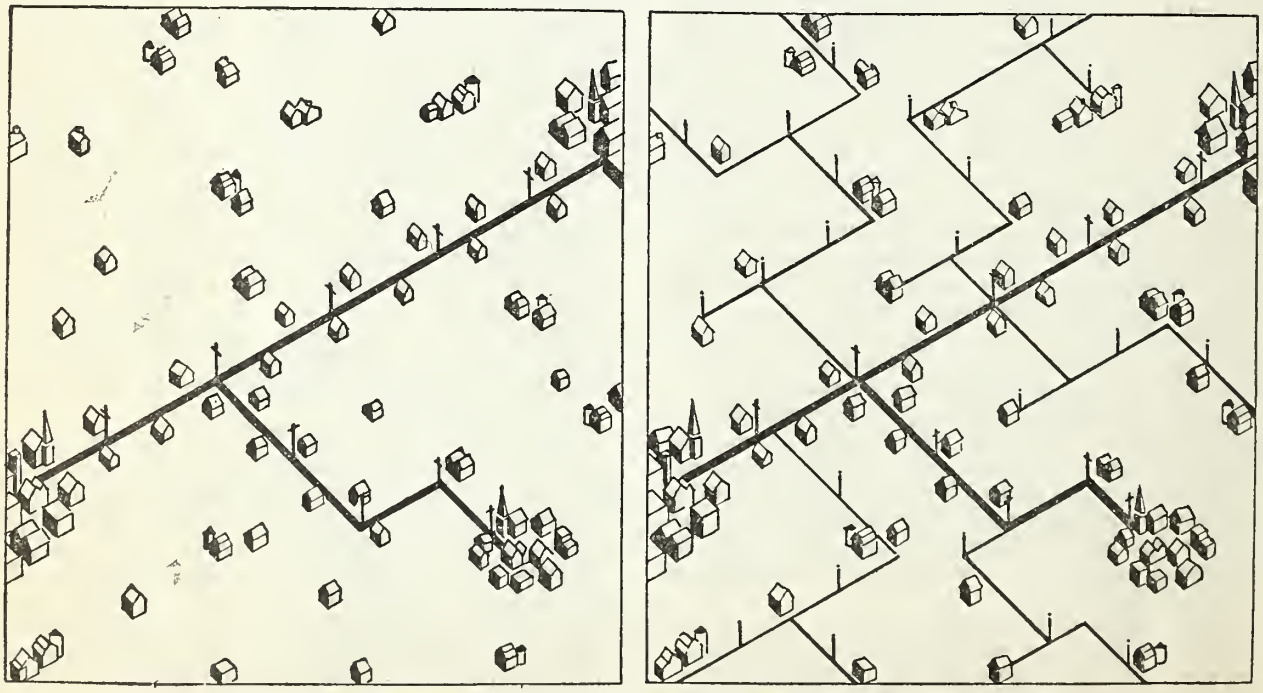


FIGURE 2.—The old and the new principles guiding the development of rural electrification.

Area coverage avoids leaving gaps of unserved sectors or stranded farms on the fringes (fig. 2). The boundaries of a service area are determined largely by geographic and physical considerations, to assure compact operating systems.

The outworn practice of providing service selectively only to those farms and rural homes readily accessible from the highways, or located in densely populated areas, or promising relatively large immediate loads and ignoring other potential consumers, has deprived many farms of electric service. This practice of "skimming the cream" not only restricts the number of dwellings that can have service, but also results in high construction costs because of piecemeal additions from time to time. Experience has shown that construction to serve all rather than a selected few permits mass-production methods in the development and more efficient management in the operation of these local systems. The net results are lowered costs and availability of high-line service to all people in a rural area.

Unserved pockets inevitably result from selective extensions. They cannot be taken care of even with REA financing, unless the lower consumer density in these pockets can be counterbalanced by higher density sections within the same distribution systems, or the lines physically integrated with others in such a way as to bring the fixed costs down to a low unit figure. The goal of area coverage rural electrification will not be reached if power companies attempt to revive the rather general prewar practice of "cream skimming."

DEMAND FOR ELECTRIC HOUSEHOLD AND FARM PRODUCTION EQUIPMENT

In estimating the active demand for rural-household appliances and farm productive equipment after the war, it will be helpful to consider the relative degree of saturation of some of the major electrical appliances now. On the basis of pre-war surveys and other available data, REA estimates the amount and value of major electrical equipment in use on farms in the United States in 1943 as shown in table 3.

This estimate omits the amount and value of plumbing equipment installed in farm homes using electric water pumps. Furthermore, it takes no account of a large variety of electric home and farm appliances known to be in use on many farms, but for which no reliable survey data are available. The items omitted comprise not only those in the "gadget" category, but also such thoroughly useful items as ironers, pig brooders, electric-fence controllers, egg candlers, insect traps, and graders for fruits and vegetables.

However, even with regard only to major appliances, a mere projection of these estimates into the post-war period would give a wrong picture of the active demand to be expected. There is a cumulative demand from already electrified farms for electrical equipment not obtainable during the war. This includes replacements as well as additional equipment desired. Also, there is the prospect of new types of appliances and equipment not generally

TABLE 3.—*Estimated amount and value of major electrical equipment on United States farms, 1943*

Kind	Percent of farms having electricity	Units	Average value per unit	Total value
Home appliances:		*Number*		
Radios	90	2,208,690	$40.00	$88,347,600
Irons	85	2,085,985	4.00	8,343,940
Washing machines	55	1,349,755	75.00	101,231,625
Refrigerators	40	981,640	150.00	147,246,000
Toasters	30	736,230	5.00	3,681,150
Vacuum cleaners	20	490,820	60.00	29,449,200
Hot plates	15	368,115	2.50	920,287
Coffee makers	9	220,869	4.50	993,910
Electric ranges	4	98,164	130.00	12,761,320
Roasters	2	49,082	24.00	1,177,968
				394,153,000
Farm equipment:				
Brooders	25	613,525	25.00	15,338,125
Water pumps and installation	25	613,525	135.00	82,825,875
Electric motors	20	490,820	25.00	12,270,500
Cream separators	15	368,115	125.00	46,014,375
Milking machines	10	245,410	175.00	42,946,750
Milk coolers	7	171,787	165.00	28,344,855
Poultry water warmers	2	49,082	3.50	171,787
Dairy water warmers	1	24,541	35.00	858,935
Feed grinders	1	24,541	75.00	1,840,575
				230,611,777
Total investment in major home and farm equipment in use on farms				624,764,778

available through commercial channels before the war. Some, like the farm freezer, had just about reached the market when war came. Others, particularly equipment based on the progress made in electronics during the war, are being developed for the great potential post-war market.

As indicated in table 3, most farm families have so far invested more money in electric household appliances than in electric farm equipment. Household uses of electricity, the advantages of electric lights, radio, washing machine, iron, and refrigerator, are so well known that they have naturally received first consideration.

Because of the low percentage of farm electrification prior to creation of REA, not much attention was paid to the manufacturing and marketing of low-priced, efficient electric farm equipment. It is therefore not surprising that the sudden Nation-wide expansion of rural electrification found most farmers unprepared to make profitable use of electricity.

However, much progress has been made since 1936. Pertinent publications by REA, the Extension Service, and other Federal agencies, and by State agricultural colleges, a wider dissemination of manufacturers' literature, demonstrations of electrical

farm equipment in electrified areas, the national farm-equipment tour conducted by REA, the cumulative effect of the examples set by forward-looking farmers in electrified areas, and of their outstanding performance in war food production—all of these have resulted in a rapid change of attitude concerning the farm uses of electricity. It is therefore obvious that there will be a far greater demand for electric farm equipment as well as for household appliances after the war.

DEMAND FOR WATER-PRESSURE SYSTEMS AND PLUMBING

As indicated in table 3, only about 25 percent of all electrified farms had electric water pumps in 1943. And not all of these farms were equipped with complete water and plumbing systems.

A modern water and sewage disposal system is probably the greatest single benefit which electricity can bring to a farmstead. Why, then, are so few farms so equipped? In all probability, the initial cost of the water and plumbing system itself is the major reason, coupled with the bother and cost of incidental building alterations and a lack of understanding of how running water can be utilized to increase income to offset its cost. Farm people who had never experienced the convenience of running water in the home were too readily resigned to the belief that the tedious, antiquated practice of hauling water from well or hand pump must continue as one of the unavoidable burdens of farm life. In the case of tenant-operated farms, the owner did not measure the value in attracting good tenants against the cost outlay. Since the installation of a farm water system and plumbing entails a considerable expense, it is understandable that farm people, when obtaining electricity for the first time, were inclined to postpone these improvements in favor of other uses of electricity whose benefits in relation to cost were more obvious.

Actually, water under pressure on the farmstead can serve a variety of extremely important uses. Running water in the home (preferably hot and cold) at the kitchen sink, the washtub, the bathtub or shower, and for a flushing toilet and appropriate sewage disposal, means less drudgery, greater comfort and better health for the entire family. On the farm, water under pressure offers protection against fire, saves labor of pumping and carrying water for poultry and livestock, increases farm income by providing plenty of drinking water around the clock, for poultry and livestock, and by insuring the farm vegetable garden against the effect of prolonged dry spells.

For these reasons, rural planners and educators now include water-pressure systems for the farm and rural homes as an essential of better rural housing standards. Shortly before the war, many REA-financed electric cooperatives undertook special educational efforts, with the assistance of REA, to make their members more fully aware of the importance of a farm water system and plumbing. The Extension Service, Vocational Agriculture teachers, and departments of agricultural engineering and home economics in land grant colleges also undertook related educational programs. As a result, the demand for water systems on electrified farms was growing noticeably until the war interrupted this farm plumbing program. It is highly probable that the post-war demand will far exceed the pre-war demand.

FINANCING OF LINE CONSTRUCTION

Before the war, the electric utility industry generally did not request Government financing for what rural lines it decided to build. There is no evidence to indicate that there will be any change in this policy after the war.

Past experience, however, indicates that a large part of rural line construction after the war will have to be undertaken by nonprofit, farmer-owned cooperatives if universal low-cost electric service is to be made available to rural America. How large this construction program will be and how rapidly it can be carried out will depend primarily on action of the United States Congress. The attitude of the Congress appears to be indicated by the recent passage of the so-called Pace Bill, which lowers the interest rate on REA loans below the scale originally set in the REA Act of 1936, and extends the permissible period of amortization. This broadening of the loan-financing conditions will make it possible for REA-financed cooperatives generally to do a more complete area-coverage job than would otherwise be the case.

FINANCING OF CONSUMER PURCHASES

Since cash payment or private financing of wiring, plumbing, and electric purchases by consumers was the general practice before the war, it may be assumed that the accumulation of war savings will favor a continuation of that practice in the post-war period. Still, it would be overoptimism to expect that each farm family's war savings will be adequate for purchases of electric farm equipment and home appliances, as well as for purchases of other consumer goods and for making needed farmstead improvements.

In the interest of a stable peacetime economy, it may become advisable for the Federal Government to supplement individual and commercial financing of wiring, plumbing, and electric equipment purchases by rural consumers. Authority for consumer purchase financing is contained in the REA Act. Although such financing has been freely offered to REA borrowers ever since 1936, it accounts for only 2½ percent of the total of REA loans.

IMPORTANCE OF LOCAL INITIATIVE

The only way a farmer can get electric high-line service to his farm is by going after it. No electric cooperative or other supplier will serve him until he has applied for the service. And no one can afford to build lines in any area unless the people in the area have indicated their desire for electric service. This means that there can be no rigid, centralized planning from the top down. The details of a national program of rural electrification must be based on locally developed plans.

As shown in figure 5 (page 17), the location of unelectrified rural establishments is known in a

general way. But howsoon and how vigorously after the end of the war in Europe rural electrification can proceed in any particular area, will depend primarily on the vision and action of the people in that area.

Local planning for rural electrification should not stop with getting the lines built. It should include the effective utilization of electricity for various community improvements as indicated in preceding parts of this statement. And it might profitably concern itself also with what electricity can do in connection with the development of soil conservation practices and with other problems of most effective land use.

COORDINATION WITH RELATED PROGRAMS

Development of all the resources of a natural area, such as the drainage area of a river system, must include as a major objective the electrification of its rural homes and service and cultural establishments. The REA program has contributed somewhat to the success of other programs in the past and has in turn derived great benefits from them—engineering specifications, development practices, and especially low wholesale rates. The wholesale rate paid by REA cooperatives in the Tennessee Valley is only a little more than half the average for the Nation. The average power consumption by their members is substantially higher than the national average and much above the average in neighboring States. The same is true where the influence of Boulder Dam, Grand Coulee, Bonneville, the Southwestern Power Administration, and other such developments is felt. If other Valley Authorities come into existence, after the TVA pattern, similar advantages and furtherance of rural electrification may be confidently expected.

Part 5

SCOPE OF THE OVER-ALL PROGRAM

It should be clear from what has been said before, that no complete and detailed blueprint for a national post-war rural electrification program can be worked up at this time. But enough facts and indications of trends are available to show what needs to be done and to arrive at a reasonable estimate of what can be done as soon as the materials and manpower situation will permit.

The following estimates are based on various sources of information, including census data, REA experience and studies, information obtained from REA-financed cooperatives, from State agricultural post-war planning committees, and from various bureaus of the Department of Agriculture.

It is estimated that about 952,000 of the 6,344,000 unserved rural dwelling units, shown in table 2, are located in suburban areas and can be served by urban power systems. This reduces to 5,392,000 the number of unserved rural dwellings which will need to be considered in a strictly rural post-war electrification program. As shown graphically in figure 3, it is estimated that the cost of line construction, based on REA pre-war construction costs, to reach these 5,392,000 potential rural consumers will amount to about $1,600,000,000, and that about 800,000 man-years of direct and indirect labor will be required to do the job.

No one can foretell how long it will take to complete this job. But it is REA's considered estimate that about 3,655,000 of these potential rural consumers can be reached within 5 years after line construction materials have again become generally available. This would, of course, require an intensive construction program not only by REA borrowers, but also by all other groups and agencies concerned with supplying rural electric service. It is virtually impossible to forecast or even to estimate reliably how long it might be until the remaining 1,737,000 potential rural consumers (or whatever the number may turn out to be as a result of rural population changes since the 1940 census) will get service. Detailed discussion is therefore confined to the immediate 5-year program.

AN IMMEDIATE 5-YEAR PROGRAM

The following estimates include construction by all agencies, private utilities, cooperatives, and public bodies. As shown graphically in figure 3, it will require the expenditure of about $1,042,000,000, based on REA pre-war construction costs, for construction of lines to serve 3,655,000 additional rural consumers. It will involve about 521,000 man-years of direct and indirect labor for line construction. It is based on the validity of the assumptions that (1) materials and manpower will be available as rapidly as needed; (2) that private and public rural power systems are willing and able to undertake area-wide line-construction programs.

This line-construction program will result in considerable expenditures by these newly connected consumers for the wiring of their premises, for plumbing installations, and for the purchase of electric farm and household equipment and appliances. Also, rural establishments electrified before the war will need additional wiring, plumbing installations, and a variety of electric equipment.

As shown in table 4, it is estimated that these old and new rural consumers offer an almost immediate market for wiring jobs totaling about $752,000,000, for plumbing installations totaling about $708,000,000, and for farm and household appliances totaling about $3,066,000,000, or a grand total of $4,526,000,000, involving about 2,263,000 man-years of direct and indirect labor.

These figures leave out of consideration the demand for wiring and electrical equipment in connection with the electrification of schools, churches, and other community buildings, the establishments of new and the electrification of existing rural service and processing industries and other commercial enterprises. But even with that omission the rural electrification program, if vigorously carried out, can account for 5½ billion dollars of national industrial production, and can result in 2¾ million man-years of private employment, largely within a period of 5 years.

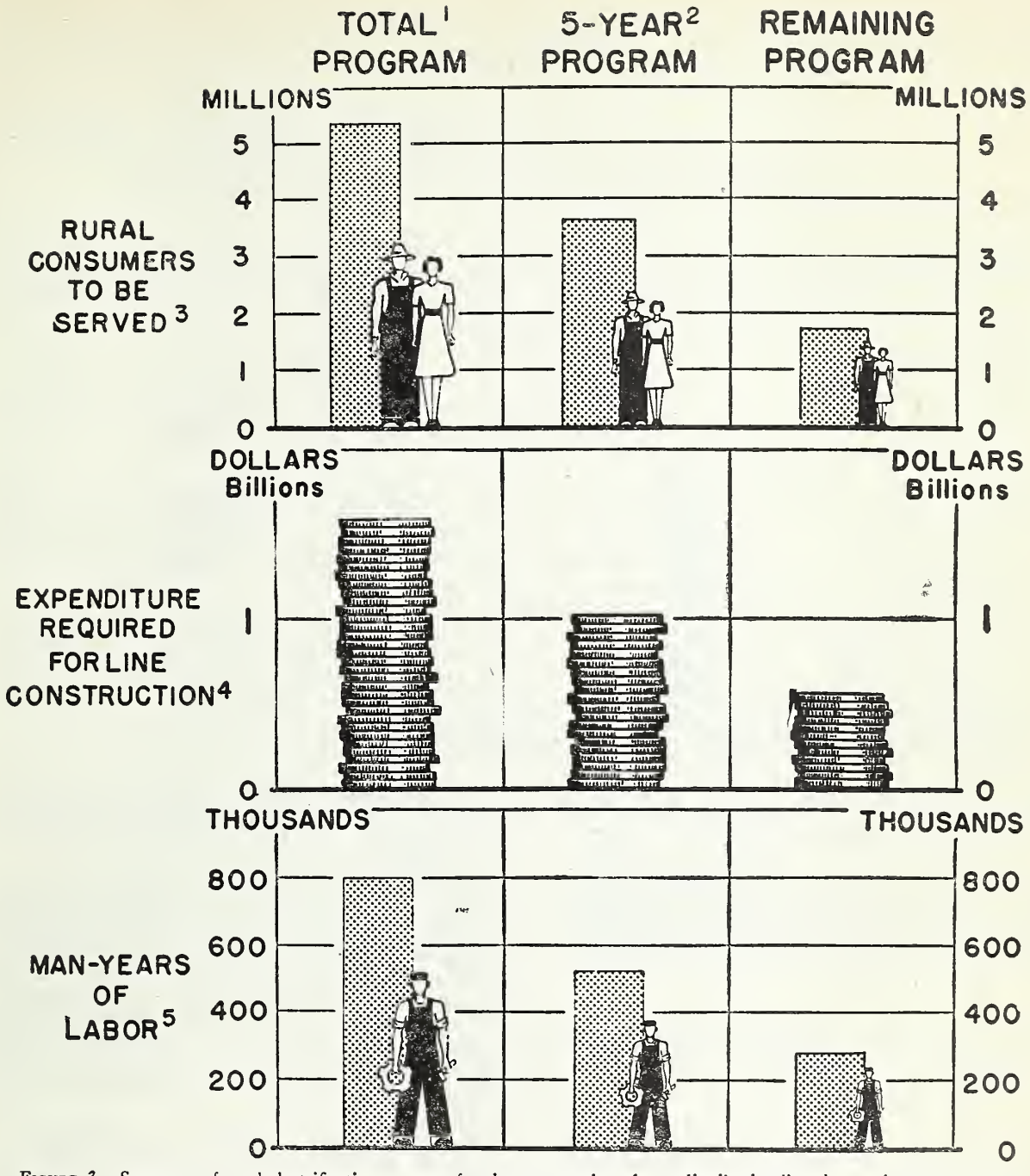


FIGURE 3.—Summary of rural electrification program for the construction of new distribution lines by rural power systems in the United States.

January 1, 1944

1. The total program to be accomplished from January 1, 1944, will be reduced by the number of rural consumers electrified during the period of restricted wartime activity. It is estimated that an average of 11,530 new rural consumers will be served each month by all rural power systems for the duration of the restricted program. This estimate is based on a careful analysis of consumer connections from the program's inception.

2. An estimate of rural establishments without electric service as of January 1, 1944, which must be served by rural utility systems as distinguished from approximately a million rural nonfarm establishments located on the fringe of urban development which may best be served by urban utilities.

3. The 5-year immediate post-war period after materials and manpower become available in quantities sufficient to permit general resumption of primary line construction.

4. Based on REA pre-war construction costs.

5. Assuming that a $2,000 expenditure will involve 1 man-year of direct and indirect labor.

TABLE. 4—*Estimate of rural consumer expenditures for wiring, plumbing, and electric farm and household equipment during the immediate post-war period* [1]

	By consumers connected prior to Jan. 1, 1944 [2]	By consumers connected during proposed 5-year [3] construction program	Combined consumer purchases
Expenditures for wiring:			
Farms	102, 280, 000	397, 445, 000	499, 725, 000
Other rural dwellings	170, 000, 000	82, 278, 000	252, 278, 000
Total	272, 280, 000	479, 723, 000	752, 003, 000
Man-years of labor [4]	136, 140	239, 861	376, 001
Expenditures for plumbing:			
Farms	287, 662, 000	215, 854, 000	503, 516, 000
Other rural dwellings	153, 000, 000	51, 424, 000	204, 424, 000
Total	440, 662, 000	267, 278, 000	707, 940, 000
Man-years of labor [4]	220, 330	133, 639	353, 969
Expenditures for electric farm and household equipment:			
Farms	767, 100, 000	1, 096, 400, 000	1, 863, 500, 000
Other rural dwellings	1, 020, 000, 000	182, 840, 000	1, 202, 840, 000
Total	1, 787, 100, 000	1, 279, 240, 000	3, 066, 340, 000
Man-years of labor [4]	893, 550	639, 620	1, 533, 170
Total of wiring, plumbing, and electric farm and household equipment:			
Total expenditures	2, 500, 042, 000	2, 026, 251, 000	4, 526, 293, 000
Total man-years of labor	1, 250, 000	1, 013, 120	2, 263, 140

[1] Refer to text for basis of expenditure estimates.
[2] Purchases during the 5-year period after materials and manpower have become generally available.
[3] Purchases during the 5-year period following initial connection under the construction program.
[4] Under the assumption that each $2,000 of expenditure involves 1 man-year of direct and indirect labor.

BASIS OF CALCULATION OF CONSUMER EXPENDITURES

A number of tangible and intangible factors entered into the estimates of consumer expenditures shown in table 4. The basis of calculation finally used is outlined below. All costs are based on pre-war prices and wages.

EXPENDITURES DURING THE 5-YEAR PERIOD BY CONSUMERS CONNECTED BEFORE 1944

For additional wiring, the 2,557,000 farm consumers will spend an average of $40 each, the 6,800,000 other rural consumers an average of $25 each. For plumbing, about 50 percent of the 2,557,000 farm consumers will spend an average of $225 each, and of the 6,800,000 other rural consumers about 10 percent will spend an average of $225 each. For electric equipment the 2,557,000 farm consumers will spend an average of $300 each, and the 6,800,000 other consumers an average of $150 each.

EXPENDITURES BY RURAL CONSUMERS CONNECTED UNDER THE 5-YEAR PROGRAM

Since it cannot now be determined how many consumers will be connected during each of the 5 years, this consumer expenditure estimate is based on what purchases each consumer can be expected to make within 5 years after receiving service. As in the previous calculations, differentiation is also made between farm and other rural consumers. It is estimated that of the total of 3,655,000 consumers to be served under the 5-year program, about 2,741,000 will be farm consumers and 914,000 will be other rural consumers.

For wiring, the 2,741,000 farm consumers will spend an average of $145 each, and the 914,000 other rural consumers an average of $90 each. For plumbing, 35 percent of the farm consumers and 25 percent of the others will spend an average of $225 each. For electrical equipment, the farm consumers will spend an average of $400 each, and the others an average of $200 each.

All of these estimates are, of course, based on the assumption of a continued high agricultural income during this period. Programs like the one here outlined are among the best means of keeping up national employment and purchasing power.

Part 6

PROPOSAL FOR A THREE-YEAR REA PROGRAM

The Department of Agriculture has proposed that the Rural Electrification Administration complete necessary plans for a 3-year program of rural electrification through REA-financed rural power systems. Preliminary steps have already been taken in the planning of such a 3-year program.

This proposal contemplates that central-station service be made available, under the provisions of the Rural Electrification Act, to slightly more than 1¼ million farms and rural homes of America. This program would require, as shown in figure 4, loans totaling about 579 million dollars for the construction of distribution lines and installation of electric facilities. It would require nearly 300,000 man-years of direct and indirect labor. Estimated expenditures for wiring, plumbing, and farm and household equipment, would run to an additional 700 million dollars.

For the purpose of financing the construction of necessary lines and installations of related facilities in this REA program, the established REA policy of making only self-liquidating loans to qualified borrowers will be continued. These interest-bearing loans will be in accordance with the provisions of the Rural Electrification Act of 1936, as amended.

A tentative breakdown by States of the proposed 3-year line construction program is shown in table 5. The State figures are based on unelectrified farm surveys conducted by REA-financed cooperatives, on applications received by REA or now being prepared, and on other available information. While the actual program in any one State may vary from these estimates, REA is confident that the program as a whole can be carried out, provided that costs will not be much higher than before the war, and provided that the necessary detailed planning can be done in advance.

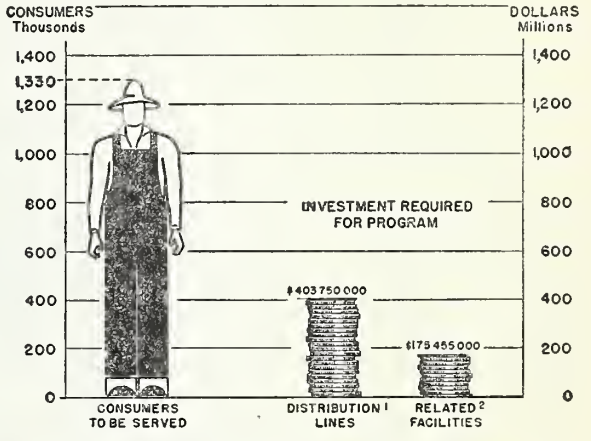


FIGURE 4.—Three-year post-war program for rural electrification.

1. The 3-year period after materials and manpower become available in quantities sufficient to permit general resumption of primary line construction. Construction costs are based on REA pre-war experience.

2. Loan funds to finance the improvement of existing electric systems, the construction of generation and transmission facilities, and the purchase by rural consumers of farm and home electric installations.

Part 7

HOW THE JOB CAN BE DONE

The national job outlined in this publication is to see to it that 3,655,000 now unserved rural establishments get electricity in 5 years after lifting of war-time restrictions (see fig. 3). REA stands ready to do its part. But the job cannot be done unless all agencies and groups concerned in the effort, including, above all, the rural people themselves, will cooperate to the best of their ability.

Practically all rural power systems, whether private or public, whether profit corporations or nonprofit cooperatives, can contribute toward reaching the proposed goal. While it appears likely that the majority of unserved farms can be served most economically through locally owned and controlled REA-financed cooperatives, there are also many areas already opened up by power companies where much remains to be done in order to render low-cost service to all rural people in the area who want it. All rural line construction after the war should be planned in accordance with the principle of area coverage.

TABLE 5.—*Proposed three-year REA program for post-war rural electrification, by States* [1]

[Tentative]

State	Rural consumers to receive service	Total man-years of labor	Investment required for program	
			Distribution lines	Related facilities [2]
	Number	*Number*	*Dollars*	*Dollars*
Alabama	42, 700	5, 000	10, 000, 000	2, 000, 000
Arizona	5, 200	1, 000	2, 000, 000	100, 000
Arkansas	47, 400	7, 500	15, 000, 000	5, 100, 000
California	3, 700	800	1, 500, 000	750, 000
Colorado	15, 900	3, 000	6, 000, 000	3, 400, 000
Connecticut				
Delaware	3, 000	500	1, 000, 000	250, 000
Florida	10, 100	1, 500	3, 000, 000	1, 750, 000
Georgia	89, 500	10, 000	20, 000, 000	5, 600, 000
Idaho	5, 100	1, 000	2, 000, 000	1, 950, 000
Illinois	42, 700	7, 500	15, 000, 000	4, 500, 000
Indiana	34, 900	5, 000	10, 000, 000	4, 525, 000
Iowa	51, 600	10, 000	20, 000, 000	7, 000, 000
Kansas	23, 300	4, 500	9, 000, 000	3, 600, 000
Kentucky	46, 600	6, 000	12, 000, 000	3, 500, 000
Louisiana	37, 500	5, 000	10, 000, 000	6, 100, 000
Maine	1, 300	200	400, 000	125, 000
Maryland	6, 900	1, 200	2, 500, 000	800, 000
Massachusetts				
Michigan	12, 300	2, 000	4, 000, 000	3, 600, 000
Minnesota	57, 700	11, 000	22, 000, 000	9, 500, 000
Mississippi	53, 300	6, 000	12, 000, 000	3, 500, 000
Missouri	114, 600	15, 000	30, 000, 000	16, 500, 000
Montana	10, 300	2, 000	4, 000, 000	1, 100, 000
Nebraska	24, 700	5, 500	11, 000, 000	2, 300, 000
Nevada	500	100	200, 000	55, 000
New Hampshire	2, 800	500	1, 000, 000	950, 000
New Jersey	800	200	300, 000	150, 000
New Mexico	8, 200	1, 500	3, 000, 000	1, 150, 000
New York	6, 600	1, 000	2, 000, 000	850, 000
North Carolina	71, 200	9, 000	18, 000, 000	10, 000, 000
North Dakota	15, 600	3, 000	6, 000, 000	3, 000, 000
Ohio	16, 500	2, 500	5, 000, 000	2, 750, 000
Oklahoma	77, 700	12, 500	25, 000, 000	13, 800, 000
Oregon	13, 300	2, 500	5, 000, 000	2, 000, 000
Pennsylvania	17, 200	3, 000	6, 000, 000	5, 300, 000
Rhode Island				
South Carolina	34, 000	3, 800	7, 500, 000	3, 550, 000
South Dakota	14, 700	3, 000	6, 000, 000	1, 750, 000
Tennessee	57, 900	6, 000	12, 000, 000	4, 600, 000
Texas	157, 200	25, 000	50, 000, 000	16, 000, 000
Utah	2, 500	400	750, 000	800, 000
Vermont	4, 000	800	1, 500, 000	1, 850, 000
Virginia	26, 200	4, 200	8, 500, 000	6, 700, 000
Washington	12, 200	3, 000	6, 000, 000	1, 750, 000
West Virginia	3, 200	500	1, 000, 000	350, 000
Wisconsin	34, 400	6, 000	12, 000, 000	8, 700, 000
Wyoming	9, 800	2, 000	4, 000, 000	1, 300, 000
Alaska	900	200	400, 000	350, 000
Virgin Islands	1, 600	100	200, 000	200, 000
United States and Territories	1, 329, 300	202, 000	403, 750, 000	175, 455, 000

[1] The 3-year period after materials and manpower become available in quantities sufficient to permit general resumption of primary-line construction. Construction costs are based on REA pre-war experience.

[2] Loan funds to finance the improvement of existing electric systems, the construction of generation and transmission facilities, and the purchase by rural consumers of farm and home electric installations.

HOW STATE UTILITY COMMISSIONS CAN HELP ELECTRIFICATION PROGRAM

State Utility Commissions have recognized generally that the REA-financed electric cooperatives, operating on a nonprofit basis and for the benefit of the member-consumers, need not be regulated in the public interest. Regulation is intended to protect the buyer from exploitation by a seller with monopoly rights. A cooperative enterprise is self-regulatory because it is owned and operated by the members served. As community enterprises, electric cooperatives have the objective of low-cost area-wide electric service to all potential consumers. This can be accomplished only by prudent management. It is in the interest of the cooperative members as owners and users, and of REA, as chief creditor, to make sure that sound management obtains.

State utility commissions are, of course, interested in maximum low-cost rural electrification. They can aid that objective by exercising their regulatory powers to assure adequate low-cost supplies of power to cooperatives, by encouraging liberalization of rural line-extension requirements of private power companies and by eliminating rate discriminations and promoting rate reductions for rural power service.

They can also aid the objective of full area coverage by preventing further "cream skimming" by power companies. If a power company is not willing to guarantee the extension of rural electric service on an area-wide basis, the people themselves should be given full opportunity and encouragement to undertake the development of both high- and low-density territory (fig. 5) combined on a nonprofit basis.

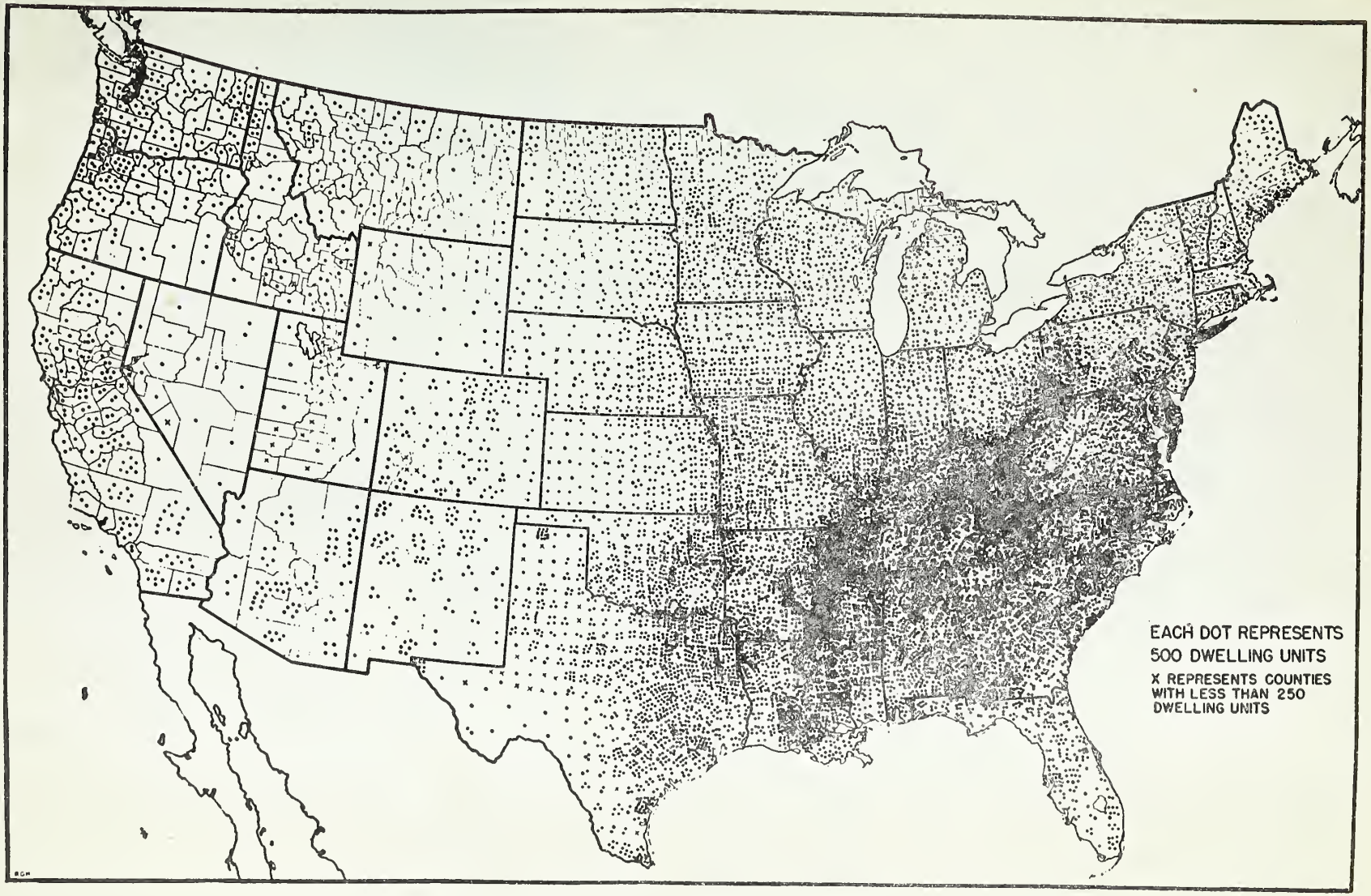


FIGURE 5.—Rural farm and nonfarm dwelling units without electric service, by counties, 1940.

Undoubtedly, more rural people will obtain electric service in that way than if commercial power companies were permitted to disregard the public interest by pre-empting the higher density territory in an area and thereby jeopardizing the feasibility of service to the rest of the area.

HOW AGRICULTURAL LEADERS AND EDUCATORS CAN HELP

Planning by individual community and State groups is the necessary first step toward formulating a sound plan which will meet both sectional and national needs. Local plans, however, must be integrated into a national plan, based upon the Nation's needs and experience, in order to serve both local and national interests. A frank exchange of views between local and national groups interested in rural electrification, and joint analysis of problems and proposals, has been not only helpful but necessary to the great progress made in the past. Concerted action on a national scale is essential to continued advancement. Cooperation with other groups, such as national and State farm groups and associations of cooperatives having a wholesome and legitimate interest in the rural electrification program, also has been helpful in the past and should continue in the future.

In their reports, the State agricultural post-war planning committees have done great service for the farmers of this country by pointing out the need of accelerated efforts for electrifying farms. A number of these reports pointed out that many power companies were not interested in doing an area-coverage job. Several emphasized that the only hope of getting electric service to many unserved farms is through REA-financed, farmer-owned cooperatives. These committees can do much through influencing the thinking of groups concerned with other phases of rural community improvements, by calling attention to the contribution rural electrification can make to better housing, better health and sanitation, adequate clinical and hospital facilities, school modernization, and establishment of community services and rural industries.

EDUCATIONAL ASSISTANCE BY FEDERAL AND STATE AGENCIES

How to obtain the full benefits of an electrical age and to build an effective electro-agriculture must still be learned by most of the Nation's farm families. Electricity is too new a tool, even for those who have already had it for a few years, for them to have discovered and brought to realization its many possibilities for improving farm management and farm living conditions and rural community life.

Before the war, REA engaged in and encouraged continuous study of the many beneficial uses of farm electricity. The successful techniques worked out and applied to a limited degree in the pre-war years, and necessarily curtailed during the war, must be revived and expanded at the earliest possible moment if consumer expenditures are to be made on the basis of knowledge.

Educational services of the Department of Agriculture and other Government bodies, through agencies concerned with rural educational programs, such as the Extension Service, Agricultural Education Service, State agricultural colleges, can help farm people learn how to use electricity more effectively. Providing farmers with knowledge of how to make greater use of power on the farm offers a challenge to researchers and educational groups alike.

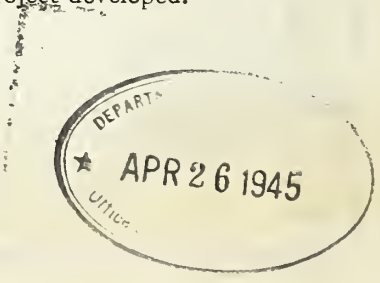
HOW FARMERS CAN HELP

The most important factor in the Nation's future rural electrification program will be planning by local people. Locally developed plans for rural electrification establish a basis for a national program which directly concerns the Rural Electrification Administration. The Department of Agriculture is in turn considering rural electrification needs and opportunities as an integral and coordinated element in the over-all national agricultural post-war plans it is helping farmers to develop.

Farmers can help by taking the initiative. If rural America is to have area-wide electric power made available it must be remembered that the program, to succeed, must be developed as a "grass roots" program.

Any farmer or group of farmers still without electricity should, without delay:

1. See the manager or local representative of the REA-financed cooperative whose lines come nearest to his farm, or
2. If no REA cooperative is established in the area, write to the Rural Electrification Administration, United States Department of Agriculture, St. Louis 2, Mo., for information. REA can usually arrange for a field representative to meet with a group or committee to explain the rural electrification program and to give advice on how electric service may best be obtained.
3. Talk to the local county agent or home demonstration agent, who may know of others in the area who would like to join in getting an electrification project developed.



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