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IOWA

STATE PLANNING BOARD

PUBLIC SERVICE DIVISION

Iowa
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april
1935

A REPORT OF PROGRESS

Iowa
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Iowa State planning board
Report of progress

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PUBLIC SERVICE DIVISION

Project 1051 and 1052

-

A Report of Progress

April 1935

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PUBLIC SERVICE

Project 1051 - 1052

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IOWA STATE PLANNING BOARD
Public Service Division

April 1935 Progress Report

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PUBLIC SERVICE SURVEY

IN IOWA

PUBLIC SERVICE DIVISION
IOWA STATE PLANNING BOARD
Report - April, 1935

POLICY, OBJECTIVES AND PURPOSE

Policy.

It is the policy of the Public Service Division of the State Planning Board to give conscientious, unbiased study to the problems attached and to arrive at conclusions, when possible, that will benefit directly and indirectly the greatest number of people. The Planning Board is a constructive body, planning for a better state; where criticisms are cast a definite constructive plan is given whereby that which is criticized may be altered.

Objectives.

A. To determine existing public service facilities as relating to radio, gas, telephone, telegraph, urban and rural electric services.

B. To obtain pertinent data on the size, location, use, operation, and physical condition of such service facilities.

C. To study the many costs and factors affecting the rendering of such services and the rates charged.

D. To analyze the past uses, extent and trends, of such services and the possibilities as to future development.

E. To study the general organization and financial structures of public service groups, municipal and private.

F. To study and evaluate existing public services with a view of determining their correlation and equitability of service to both industry and the rural and urban homes.

G. To provide a definite plan of education, control, coordination and development of all public service groups to realize the full potentialities of commerce and industry and a higher standard of living in our homes.

The field work covers all surveys pertaining to rural and urban electric and telephone service, gas, water, sewage, intraurban transportation, central heat, and telegraph services.

The engineers collect data on availability, quality, history, source, and use, of service; and on rate structure and physical properties.

Township maps are being corrected to show the proper location of roads, dwellings, school houses, churches, cemeteries, corporation boundaries, farmsteads, rural home light plants, transmission and distribution lines, high-line farm connections, generating plants, substations, and master meters.

The maps also will contain information on ownership of farms, condition of farmsteads, specifications of electric lines, and general topography of the land.

As the surveys of each county, urban and rural, are completed and tabulated, reports will be prepared setting forth the existing service facilities, the use to which these facilities are being placed, and the recommendations and plans, if any, for immediate and long-time planned programs. The following outline reviews the progress made, to date, in the various studies.

A. Radio.

1. The Public Service Division made a study of the radio broadcasting and receiving facilities of the state as follows:

a. Constructed maps showing station location and coverage areas for each classification.
b. Listed the power, frequency, location, hours, and call letters of commercial, educational, religious, police and aviation broadcasting stations in Iowa.
c. Prepared a table showing the trend and growth in the number and power of the Iowa stations since 1921.
d. Made a study of radio receiving sets in the state by counties, as of the U. S. Census report.
e. Made a study of broadcasting programs, time schedules, and policies of each Iowa station.
f. Conducting a survey of radio sets in urban homes and station popularity survey in Appanoose county.

B. Telephone.

1. The telephone companies of the state are being visited as rapidly as conditions permit, and data pertaining to their operation is being obtained, as follows:

a. Employees; number and wages.
b. Switchboard data; make, age, capacity, type, positions, drops in use, customers served (rural, residence and business), auxiliary equipment, condition of equipment, taxes paid, operating costs, ownership, etc.
c. Miles of wire, miles of cable, miles of pole line - construction and condition.
d. Free service and toll lines.
e. Rates (business, residence, and rural), switch fees, etc.

2. A study was made on trends in service over a period of years, using U. S. Bureau of Census and State Board of Assessment and Review reports.

C. Telegraph.

1. The engineers conducting the rural surveys are collecting data on telegraph service facilities.

2. The State Board of Assessment and Review reports have been studied for trends in service.

3. A study was made on the early history of the service in Iowa.

D. Gas.

1. Three of the four municipal plants have been visited and data collected on:

a. History and financial planning.
b. Age and condition of plants and systems.
c. Operating data; receipts and expenditures.
d. Service rendered, capacity, gas generated, service rates, merchandising, etc.
e. Future planning -- improvements.

2. The rural survey engineers are visiting the private utility companies to obtain the following information:

a. History of systems, specifications, type of gas; service facilities, quality and availability of service.
b. Urban consumption in cubic feet.
c. Employees; salaries and wages.
d. Service rates.
e. Merchandising policies.
f. Future building programs planned.

3. A list of all towns served gas in the state has been prepared, together with the type of gas and company or organization serving.

4. A study was conducted on manufactured gas, as to the tendencies of use and cost, from the U. S. Bureau of Census reports.

5. Maps were prepared to show the cities receiving gas service and location of natural gas and gasoline pipe lines.

E. Electricity.

1. The engineers of the Public Service Division have visited 105 of the 128 municipally owned electric establishments to obtain the following data:

a. History and financial planning.
b. Age and condition of plants, equipment, and distribution facilities.
c. Operating data, receipts and expenditures.
d. Service rendered, capacity, energy generated, rates, merchandising, etc.
e. Future planning -- improvements.

2. The engineers, at present, are visiting the private utilities for the following information on urban and rural electric service:

a. History of plants, systems and services.
b. Specifications and condition of all rural transmission and distribution systems and operating mechanisms.
c. Consumption; urban and rural, by average and trends for several years (Kw hours and dollars).
d. Service rates.
e. Employees, salaries and wages.
f. Merchandising and load building policies.
g. Territories served.
h. Future building programs planned.

3. The incorporated towns of Iowa were listed by population groups, according to the source of service (by whom served).

4. A brief study was conducted on the history and general financial structure of the operating companies in the state.

5. A study was conducted and tables constructed as to the trends in size and type of prime movers, commercial and municipal, over a period of years.

6. A special research section has been active in the study of various rural electrification problems pertaining to:

a. Factors affecting design and construction of rural lines.

b. Rates and service policies as practiced by the public service groups.
c. Detailed study of fifteen years operation of the Kegley Branch farmer-owned and operated line.
d. Rural utilization of electric service.
e. Problems in extension and electrification of Iowa farms.

7. A study was made of energy consumption and a table prepared showing values for two different years as reported by the U. S. Bureau of Census.

8. Maps were made showing the percent of farms, by counties, having electricity, running water in the house, telephones, electric power machinery, home light plants and radios.

9. All home light plants and highline-connected farms are being spotted on the maps.

10. A table and a map showing all the electric generating plants in Iowa, municipal and private, were prepared as to type of prime movers, capacity, and type of service rendered.

12. A map was prepared showing territories served by each electric service group.

13. A map was prepared showing a straight line diagram of all primary and secondary transmission lines in the state and power plant locations.

14. Chart prepared showing Kilowatt load as found on two Iowa cities during a twenty-four hour period.

15. Charts prepared showing consumer distribution curves for several Iowa towns.

F. Miscellaneous.

1. The field engineers are collecting general data from towns in their territories on water supply and sewage disposal, as to:

a. History of systems.
b. Percent coverage of systems.
c. Service rates.
d. Type of system - source or disposition.

2. General data are being collected on central heat and intraurban transportation facilities.

G. Appanoose County.

1. Appanoose county was selected as a "problem" county for a detailed survey of rural and urban services. This survey is being carried on at the present time. In addition to the regular surveys, which are to be somewhat more extensive than in other counties, we are making:

a. A survey of urban services and appliances.
b. A survey of farm equipment on those farms having electric service.

H. Legislation.

1. A study of existing legislation has been made with a view to determining the extent of governmental control over public service facilities, and suggesting further legislation for needed control and supervision.

COMMENTS, CONCLUSIONS AND RECOMMENDATIONS

In this report, the Public Service Division is stating the conclusions and recommendations it has reached after studying the material already collected on each of the separate services. We feel that in most cases sufficient studies have been made to warrant general conclusions. The fact that Iowa has no public service commission or responsible governmental agency where public service information should be available has been a handicap in our work.

A. Radio.

Much criticism of the commercial radio station is based on the abuse of its function as an advertising medium. While advertising is the sole function of most commercial broadcasting, this advertising is sold through entertainment and educational features. The more progressive stations are coming to recognize their responsibility to the public, and are making definite efforts to eliminate harmful advertising and provide better types of entertainment.

The educational and religious stations are being driven continually to unfavorable power, time, and wavelengths, by the commercial stations. These stations, however, are rendering an important service to the citizens

of Iowa and should be protected.

The police stations, although limited in number, are rendering a valuable service in the state in combating crime. We believe that legislation should be enacted to increase the number and power of these stations and to improve the service which they render.

B. Telephone.

Iowa is served by four types of telephone companies, (1) Bell system; (2) associated independent companies operating more than one exchange; (3) independent mutual or private companies having one exchange; (4) cooperative or mutual groups of farmers owning and operating an independent line which is generally connected to some exchange for switching. There are 157 exchanges operated by the Bell system, 307 by 44 associated companies, and at least 425 by independent companies. Our studies indicate that the last figure will be increased to 500 when complete data are available. According to the report of the State Board of Assessment and Review there are approximately 3,000 rural telephone companies, farmer owned and operated.

We find both the urban and rural districts of the state well supplied with available telephone facilities. The equipment of many of the independent and a few of the associated companies is old, obsolete, and deteriorated to a point where the service is very poor. The systems owned and operated by Bell and other large groups have been well maintained, and render excellent service. These companies have done much to maintain quality service in the smaller exchanges through cooperation and assistance.

The decrepit condition of the small independent and mutual exchanges is due to a number of factors which the managements have failed to recognize, and for which no provisions have been made:

1. They have neglected to correctly account for all service costs, particularly depreciation.

2. In the past, quite generally, they have charged for service at

"below-cost" rates. The investment has been dissipated in the form of "low rates".

3. The companies have lost sight of the original investment, and have not made allowances for depreciation. The original system and equipment is now worn out, and no funds have been set aside to cover the cost of replacing them.

4. In some cases, excessive stock dividends have been paid which, actually, were not earnings, but part of the original investment.

5. The management and operation of the systems are generally in the hands of incompetent individuals.

6. In most cases, these companies have kept no accounts, and have not rendered annual financial statements.

7. In most cases, employees have not received, and are not now receiving sufficient wages.

The necessity of competing with the "service-below-cost" rates charged by many of the independent and mutual groups, has forced some of the better companies to slight the maintenance of their lines, and so allow their service to deteriorate.

Our survey shows that total service rates vary between $4.50 and $24 a year, with $12 as the most common rate. Reports indicate that the $4.50 rate is almost as hard to collect as are the higher rates.

Making suggestions to rectify the present situation is like locking the barn door after the horse is stolen. We consider telephone service necessary and worth while, but recognize the fact that some very definite changes must be made to render it financially sound, in the rural communities.

The following recommendations are offered:

1. The public should be made to recognize the true costs of service,(the decrepit condition of the present lines will do much in this program).

2. The companies should be required to keep correct and accurate

accounts, according to some uniform system. (Many companies have expressed a desire for such a system.)

3. Small telephone groups can and should be merged to make possible operating economies and competent management thereby improving service and the physical property.

Telegraph.

Iowa is served by five telegraph companies; Western Union; Postal Telegraph; and three railroad companies. Each year, more business is transacted by telephone, with the result that the number of miles of telegraph line and the number of service companies is decreasing.

Our survey has disclosed only one problem in this field, i.e., the need for better service in small towns. In most cases, these towns are serviced through the railroad station. However, the agents' hours are irregular, and at best, service is limited to eight hours.

If a message is to be sent out of town after the agents' hours, he must either be found and the station reopened, or there is a telephone toll to the town that has a 24 hour service. This is to be expected.

However, prepaid messages, sent to one of these small towns after hours, are often phoned "collect" by the nearest 24-hour station to the addressee. Such a practice seems unfair and should be corrected.

Gas.

Gas is available in 95 Iowa towns and cities having a population of 971,928, or about 67.3 percent of the total urban population. Since 1930-1931, two natural gas pipe lines have been laid in Iowa, and now serve some forty communities. Several factors have prevented many towns from taking advantage of these facilities, and the unwillingness of private utilities to expand their properties further, has retarded the use of natural gas. Numerous coal dealers and associations have acted to prevent its use, realizing that it would tend to reduce the use of coal and thereby effect their own business, as well as that of the railroads, and the coal mining interests.

The very nature of the source makes it difficult to estimate the length of time natural gas will be available. However, we feel that the many advantages provided by the use of natural gas warrant serious consideration by those towns in which it can be made available.

Many of our gas distribution systems have been in service over thirty years, and are now deteriorated to such an extent that leaks often occur. Every precaution should be taken to locate and repair such leaks before they become dangerous. In recent years, there have been brought to our attention several cases of persons being asphyxiated by gas. Such cases usually are caused by leaky mains along the service leads.

Urban Electric Service

Urban Iowa is served by 42 private serving companies and by 128 municipal electric systems. Of the 934 incorporated towns and cities in the state, all but 15 are receiving electric service.

The present generating and transmission equipment is of sufficient capacity to serve the state with adequate and dependable electric service for some years, unless an abnormal increase in consumption takes place.

Many of the private companies serving the state are subsidiaries of eastern holding companies. They are financed by the various stock and bond issues, some of which are sold on the open market and some closely held. The municipal electric establishments originating prior to 1930 have been financed mainly by the issuing of general obligation bonds. Over 50 percent of the municipalities have paid for their plants by taxation, the balance either by earnings, gifts, taxation and earnings, or by unknown means. Since that date, such establishments have in general been built under the Simmer Law, and are to be paid for from earnings.

Service costs vary greatly, being influenced both by the degree of management and by the type, size, and output of the equipment in use. Such costs are divided into the three divisions, generation, transmission, and

distribution. Fixed charges make up a major portion of all utility service costs, in that such service requires large capital investments per dollar of annual revenue.

Wholesale and retail service rates are not uniform in Iowa. They vary widely both as to type and amount even in towns of similar size, and using similar quantities of service under the same conditions. They compare very favorably with those in other states when applied to the same energy consumption, Iowa's average rate being somewhat high in comparison is due to the low consumption per consumer.

The accounting practices in many municipal establishments are not sufficient to warrant reliable conclusions as to the costs of service. During the past few years a number of these establishments have taken active steps toward improving their accounting practices.

The personnel of the electric service groups varies widely, from unskilled to technically trained individuals. The electric service industry, because of its monopolistic nature and because of the many controversial problems involved, demands the best possible public relations.

The plants and equipment in operation at the present time vary greatly as to their general condition and ages. Much of the equipment in the smaller municipal steam plants is obsolete and inefficient and should be replaced. One study shows that the life of equipment is about 16 years. The private companies have retired small plants and have increased the capacity of their generating facilities by enlarging the large central stations which are more efficient energy producing units.

There is considerable rebuilding of transmission and distribution lines necessary in the state at the present time. Much repairing has been carried on during the last few years of the depression with the thought that rebuilding would be done when conditions warranted.

The results of our survey in the urban electric service field prompt us to make the following recommendations for the ultimate improvement of service:

1. That a Public Service Commission be created, and given sole jurisdiction over electric light and power utilities.

2. That town clerks be appointed on the basis of qualifications, to be determined by civil service examinations; and that their offices be so constituted as to render real services to their communities.

3. That a uniform system of accounts be designed for municipal electric systems, and its use made mandatory.

4. That expansion and/or duplication in the electric service field be not encouraged to the exclusion and detriment of other important service facilities.

5. That some competent state governing agency (The Public Service Commission, if such is created) be given power to supervise and regulate electric service rates.

6. That municipalities consider the purchase of energy on a wholesale basis if the cost is less than that for which energy can be generated locally.

7. That all information and data required of private companies for government reports be incorporated into one composite report, and submitted to a central regulating group. (The Public Service Commission, if such is created).

8. That a program be outlined for the most effective future planning of transmission lines.

9. That a municipal utility organization be promoted for cooperative purchasing, for disseminating valuable operating data, and for retaining technical services.

10. That public relations be handled in such a way that consumers will appreciate the costs of rendering electric service and the problems involved.

11. That, in view of their economic expediency, central generating plants, both municipal and private, be encouraged.

12. That people be educated to the importance of load-building as a factor in reducing cost per kw-hr. of electricity; and that mutually beneficial mer-

chandising programs be worked out by the service groups and local merchants.

Rural Electric Service

Field Work:

The data collected in 10 representative Iowa counties surveyed, brings to light certain facts regarding the present situation in rural electric service, and the possibilities of extending this service to additional rural consumers. The present situation in these 10 counties may be summarized as follows:

1. There are 1,190 miles of farm distribution line, 287 miles of transmission line under 10,000 volts which are readily available for farm connections, and 773 miles of transmission line over 10,000 volts making a grand total of 2,250 miles of power line.

2. There are 2,967 farm consumers and 194 special rural consumers, or less than 49 percent of the 6,460 places adjacent to the present power lines that are connected.

3. The average density of consumers along the farm distribution lines is 2.3 per mile.

4. The average yearly consumption for farm customers is 472 kilowatt-hours, or less than 40 kilowatt-hours per month.

The fixed charges are the greatest items of expense on rural lines, therefore the absorption of the majority of these potential consumers along the present lines would materially decrease the fixed charge allotted to each consumer. Then by building up the individual's consumption to that point at which he would get beyond the first step in his rate or minimum charge, which is usually designed to cover the fixed charges, much of the present dissatisfaction on the part of both the farmer and the utility would be a thing of the past.

The engineers proposed 1,126 miles of feasible extensions in these 10 counties which would make service available to an additional 4,407 farms and 229 other rural prospects or an average of 4.12 prospective rural

consumers per mile of extension. These were proposed as being feasible extensions after considering the following factors:- desire for service; ownership of farms; density of farms; special prospects; and condition of the farms and terrain concerned.

As a part of this survey township maps are being brought up-to-date on road, farmstead, church and school locations, and city limits are being corrected. We have found more than 1,000 corrections necessary in some counties. The completion of this survey will make available corrected township maps for every township in the state. Whether this work is completed by this survey, or in some other manner, the State of Iowa should have maps of this type available for the use of governmental and private organizations.

Research:

The research is being conducted to study the present situation as to distribution and uses of rural electric power; to study the present rate situation and to work out general rating principles to help determine fair rural rates; and to analyze the data made available by the field survey, similar studies, publications, and other sources.

Several rather definite conclusions can be drawn from the material thus far collected, but much work remains to be done along this line. The study of the existing rural electric rates shows a chaotic condition in this field and much need for some regulatory board to standardize as nearly as possible the rates and policies for the entire state. In addition to leveling out the rates, such a body would be available as a board of arbitration where rural consumers could secure a hearing on any complaints as to unjust rates or contracts. The decision of such a board, whether it upheld the questioned

rate or declared it unjust, would tend to restore confidence. At present, the small user has no recourse within his reach and, due to a few unfortunate cases, ill feeling has developed between the utility and the consumer.

From a study of the 15 years of operation of the Kegley Branch Electric Company, farmer owned and operated, line near Story City, Iowa, we have obtained some of the most valuable information secured in this research. Complete data have been secured of the yearly cost of the line upkeep, taxes wholesale payments for energy, transformer and line losses, line efficiencies, energy consumption, transformer and energy costs for each farm, etc. Depreciation and interest charges have been carefully estimated and from these the total costs for each year have been computed. This material has been presented in detail in a separate report.

After considering all factors entering into the cost of energy to the consumer, we found the cost of the energy used in some cases averaged as much as 90 cents per kilowatt-hour throughout a whole year, while on others, using the current more liberally, it averaged as low as 6 cents per kilowatt-hour. Curves prepared on the cost of energy to individual consumers definitely show advantages of liberal usage of current, and the importance of the fixed charges as well as the relative importance of all costs going to make up the total cost. Other curves show how the cost per kilowatt-hour would have been reduced if an additional 50 kilowatt-hours per month had been used.

This line has been fairly well maintained, excellent records have been kept, and the people are very proud of the line. However, they have failed to provide for depreciation and do not consider the interest on their original investment as a part of their constant expense, consequently they do not realize what their energy is actually costing them. Even the high unit cost would be materially overcome if the individuals' consumption could be

increased by as small an amount as 50 kilowatt-hours per month. The above conditions will probably be found representative of similar lines throughout the state.

Proposed Regulation

As a basis for proposed utility regulation, studies were made of regulations in other states, and of the present regulations in Iowa. The results of these studies are given in a report under the heading, "Public Utility Legislation in Iowa".

On the basis of the facts disclosed in these studies, the Public Service Division recommends and urges the creation of a Public Service Commission with sole jurisdiction over Electric Light and Power, Heating, Gas, Pipe Lines, Transmission and Rural Electric Lines, Telephone and Telegraph, Water, Ice and Cold Storage, Street Railways, and all other utilities for which jurisdiction is not otherwise specifically delegated.

Membership--This commission should be composed of three members; one to be appointed for a term of two years, one for four years, and one for six years; and thereafter, one appointed every two years for a term of six years. Appointments should be made by the Governor, one year after he has taken office.

Appointees should be competent, unbiased, individuals, preferably with utility experience; and should hold no other active position during their encumbency. Not more than two members should be affiliated with any one political party.

Before any appointee is installed, he should have passed, in a satisfactory manner, an examination given by a Board of Civil Service Examiners; and should have been approved by the State Senate.

Members of the commission should receive remunerations commensurate with their duties as state officers, devoting their full time and capabilities to their office.

Powers--This commission should have sole power to determine the validity of utility securities; provide and enforce the use of standard systems of accounts; receive uniform annual reports; regulate service and rates; make valuations for taxing and rate-making purposes; operate public service properties during strikes or other social disorders; and make any and all other regulations and investigations necessary in carrying out the powers vested in it.

The Public Service Division also recommends that each town and city appoint a public clerk whose duties shall include: keeping all city and school records and making necessary reports therefrom; taking care of sales and gas tax reports; and assisting with income tax reports if such service is not otherwise available.

Such a clerk should be selected by civil service examinations, given by a Board of Civil Service Examiners. The names of the three highest ranking applicants should be submitted to the local officials for final selection. Three or four different examinations should be provided, in accordance with the requirements imposed by the size of the community. He should receive a salary commensurate with the duties imposed, and with the living conditions in the particular community. It may be necessary for two or more towns to cooperate by using one clerk. Such a clerk should become the State's representative in his community.

Rural Electrification Extensions

The Public Service Division, recognizing the desire of many rural people for electric service, and also recognizing the problems involved in furnishing such service; has spent some time in studying possible solutions

to these problems. Numerous extensions have been proposed in all counties in which our survey has been completed. We are collecting, where possible, all data that will be required if an extensive rural electrification program is developed.

We also have devoted some time to costs and specifications of lines, and to the costs and possible use of rural service.

In view of the possibility of funds being made available for rural electrification extensions in Iowa, the Public Service Division has worked with the Private Utility interests of the state in preparing a proposed financing and development plan, as requested by the President's special committee. The Public Service Division also has prepared a separate plan which it offers for consideration by the proper authorities. This plan provides for a "Rural Electric Service Development Corporation" to supervise the development of rural service by existing or newly created rural service groups.

PUBLIC SERVICE STUDIES

RADIO COMMUNICATION IN IOWA

INTRODUCTION

At the present time, April 1935, Iowa is served by eleven commercial, three educational, one religious, seven police, and four aviation radio broadcasting stations located within the state, besides numerous stations located outside the state borders. Changes are still being made in the location, power, and frequency of the commercial stations, though not so often as during the early days of the industry. Two more state police stations have been suggested, but have not been acted upon by the legislature. The month of March saw further changes in two of the commercial stations, with additional power and coverage.

This survey is intended, not only to show the location and coverage fields of the present broadcasting and receiving facilities, but to suggest possible developments, changes, and extensions, which will improve the radio service in the state.

HISTORY AND DEVELOPMENT

The radio industry is one of the newest, yet far from the least, of industries. Iowa's first important broadcasting station was erected in 1921. The second oldest licensee in the United States is located in Iowa, licensed in 1922. By 1926, the broadcasting field had become the subject of such bitter controversy regarding wave length, power, and broadcasting privileges, that federal intervention was necessary.

The Radio Act of 1927 was intended to prevent indiscriminate changing of wave lengths and power, and the resulting detrimental effects upon other stations. The United States was divided into five zones, with a commissioner appointed from each. Radio broadcasting facilities were allocated among the various zones and the states within each zone in

accordance with Section 9 of the act as amended, and through regulations promulgated by the Commission. Quota units to the extent of 80 for each zone were allotted, and prorated among the states according to population, each station within a state being evaluated in these units. Thus, some order came from a condition that threatened to destroy a useful industry which had a rightful place in modern living. At the present time, Iowa has considerably in excess of its allowed theoretical units. It was allowed 7.3 but now has about 11.65 assigned.

Radio Broadcasting Facilities

The growth of broadcasting facilities is best presented by the following table, showing by years the power and number of stations within the state. In 1921, we had only eight stations, five commercial, two educational and one aviation with no power listed. In 1923, we had 28 stations with a total power of 4,195 watts, and in 1935, 26 with a total daylight power of 73,350 watts.

IOWA BROADCASTING STATIONS, Number of stations, power.

Year	Total Power	Total Stations	COMMERCIAL		EDUCATION		RELIGIOUS		POLICE		AVIATION	
			No.	Power	No.	Power	No.	Power	No.	Power	No.	Power
1921		8	5		2						1	2,000
1922		12	9		2						1	2,000
1923	4,195	28	22	1,785	5	410					1	2,000
1924	5,150	22	16	1,990	5	1,160					1	2,000
1925	9,880	23	15	6,570	7	1,310					1	2,000
1926	17,390	22	16	13,980	5	1,410					1	2,000
1927	31,965	26	18	22,795	6	7,160	1	10			1	2,000
1928	26,840	24	16	17,620	6	7,160	1	10			1	2,000
1929	28,050	21	15	21,800	3	4,100	1	100	1	50	1	2,000
1930	30,000	22	15	22,200	3	5,600	1	100	2	100	1	2,000
1931	25,850	24	14	17,200	3	5,600	1	100	3	150	3	2,800
1932	27,900	27	14	17,200	3	5,600	1	100	5	700	4	4,300
1933	27,750	26	13	17,050	3	5,600	1	100	5	700	4	4,300
1934	67,750	25	12	57,050	3	5,600	1	100	5	700	4	4,300
1935	73,350	26	11	61,350	3	[illegible]00	1	100	7	1500	4	4,300

The accompanying table will give, in condensed form, the radio broadcasting facilities for commercial, police, educational, religious, and aviation groups of stations as of April 1, 1935. In the last half of March 1935 the Iowa Broadcasting Company moved its Cedar Rapids station, KWCR, to Des Moines and abandoned the call letters KWCR. The station is now KSO and operates on the same frequency as the former Cedar Rapids station but with less power. A new station, affiliated with the Columbia Broadcasting System and bringing to central Iowa listeners the Columbia network features, was built and is operating on the old KSO frequency as KRNT. The new station, KRNT, has twice the power as the old station KSO that it replaces. It is proposed that, later in the year, WMT of Waterloo be moved to a new location near Cedar Rapids and the power increased. At the present time WMT serves eastern Iowa from studios in both Waterloo and Cedar Rapids.

When KWCR was moved to Des Moines to become KSO, WMT was dropped from the Columbia chain in favor of KRNT. WMT is now associated with the Blue network of the National Broadcasting Company.

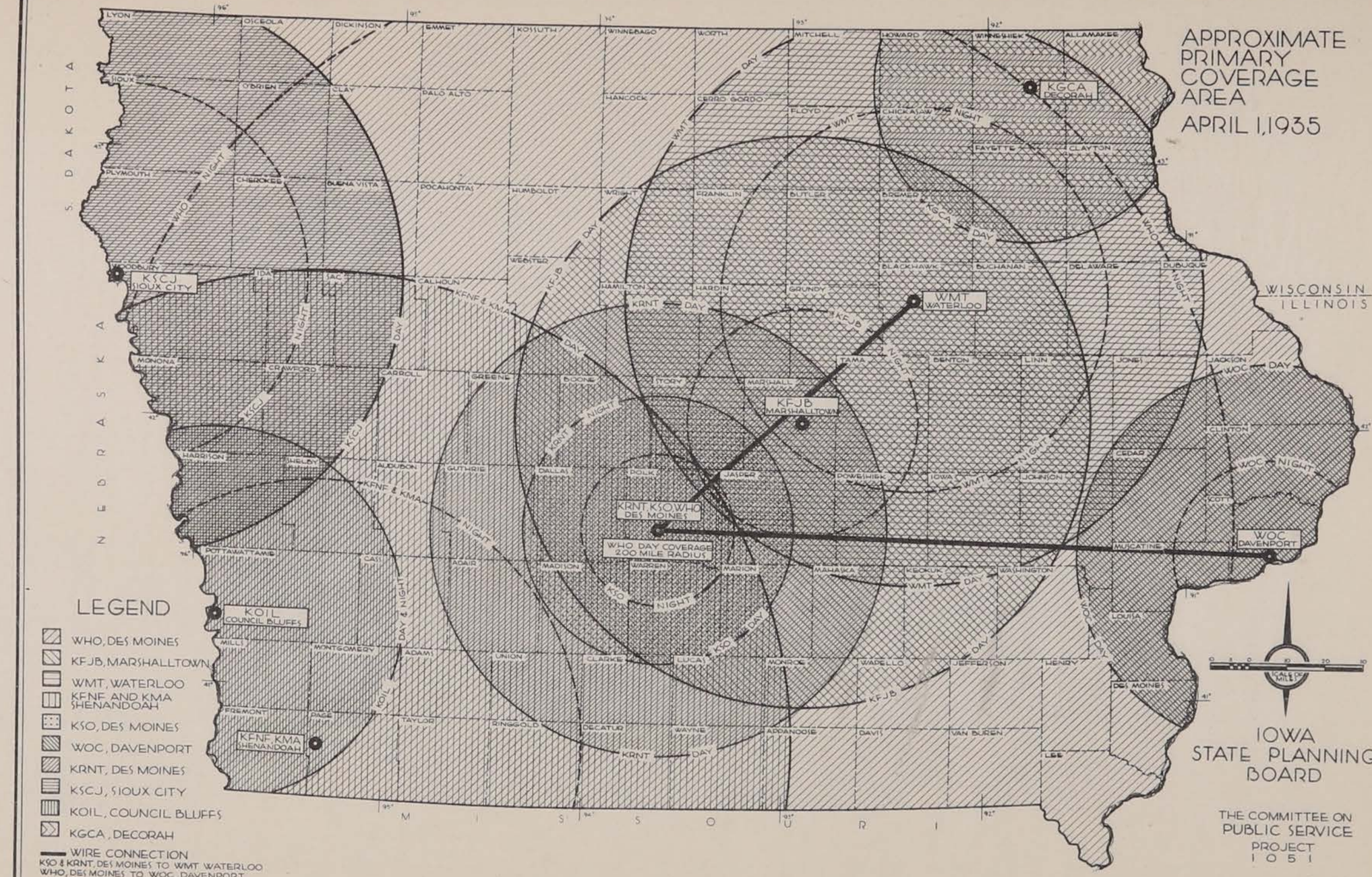
Iowa now has seven stations on national networks, making it possible for listeners with very simple receiving sets to hear coast to coast broadcasts. Stations WMT Waterloo, KSO Des Moines, and KOIL Council Bluffs are on the Blue network of the National Broadcasting Company; WHO Des Moines is on the National Broadcasting Company Red network; and stations WOC Davenport, KSCJ Sioux City, and KRNT Des Moines are on the Columbia Broadcasting System.

Besides the national network facilities several of the Iowa Broadcasting stations are interconnected by their own network systems, thus giving wider distribution to programs originating at various places within the State. These wire connections are shown on the broadcast coverage map.

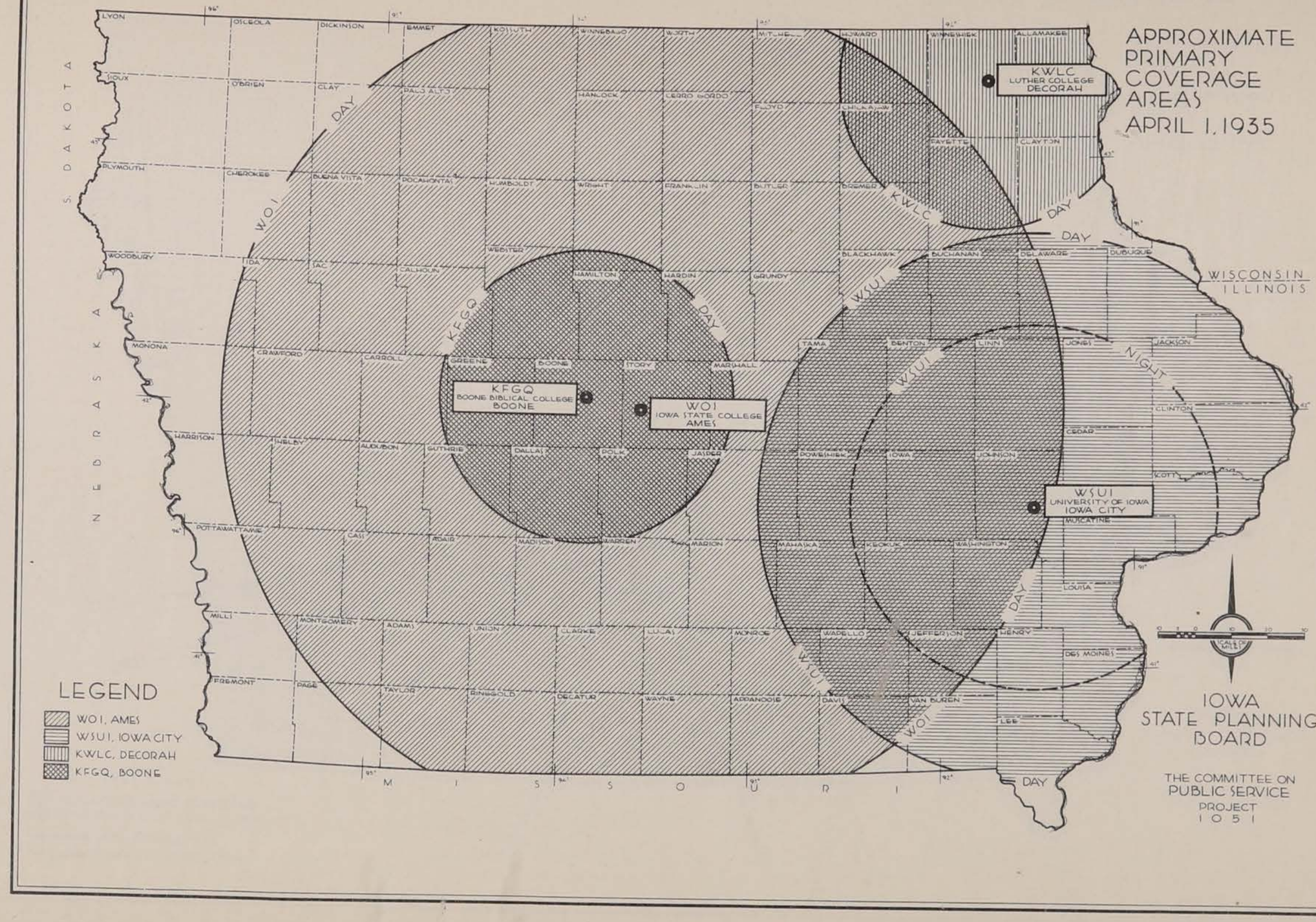
Following is a list of Iowa broadcasting stations indicating the call letters, location, power, frequency and time allotted to each station:

STATION	CITY	POWER	FREQUENCY	TIME
	Commercial			
WOC	Davenport	100W 250WLS	1,370	Unlimited
KOIL	Council Bluffs	1,000W	1,260	Unlimited
KGCA	Decorah	100WD	1,270	Daylight - sharing with KWLC
KRNT	Des Moines	500W 1,000WLS	1,320	Unlimited
KSO	Des Moines	100W 250WLS	1,430	Unlimited
WHO	Des Moines	50,000W	1,000	Unlimited
KFJB	Marshalltown	100W 250WLS	1,200	Specified hours
KFNF	Shenandoah	500W 1,000WLS	890	Sharing time with another station
KMA	Shenandoah	1,000W 2,500WLS	930	Sharing time with another station
KSCJ	Sioux City	1,000W 2,500WLS	1,330	Simultaneous - day with WTAQ, specified hours - night
WMT	Waterloo	1,000W 2,500WLS	600	Unlimited
	Educational and Religious			
WOI	Ames	5,000W	640	Daylight
KWLC	Decorah	100W	1,270	Daylight - sharing with KGCA
WSUI	Iowa City	500W 1,000WLS	880	Specified hours
KFGQ	Boone	100W	1,370	Specified hours
	Aviation and Police			
Range W	Burlington	1,500W	326	Unlimited
KQM	Des Moines	400W	D 5,662.5 N 3,178	Unlimited
KIS	Iowa City	2,000W	272	Unlimited
KQQ	Iowa City	400W	D 5,552.5 N 3,178	Unlimited
KGOZ	Cedar Rapids	50W	2,466	Unlimited
KGPN	Davenport	50W	2,466	Unlimited
KGPK	Sioux City	100W	2,466	Unlimited
KGSG	Des Moines	100W	2,466	Unlimited
KCHO	Des Moines	400W	1,682	Unlimited
KNFO	Storm Lake	400W	1,682	Unlimited
KNFN	Waterloo	400W	1,682	Unlimited

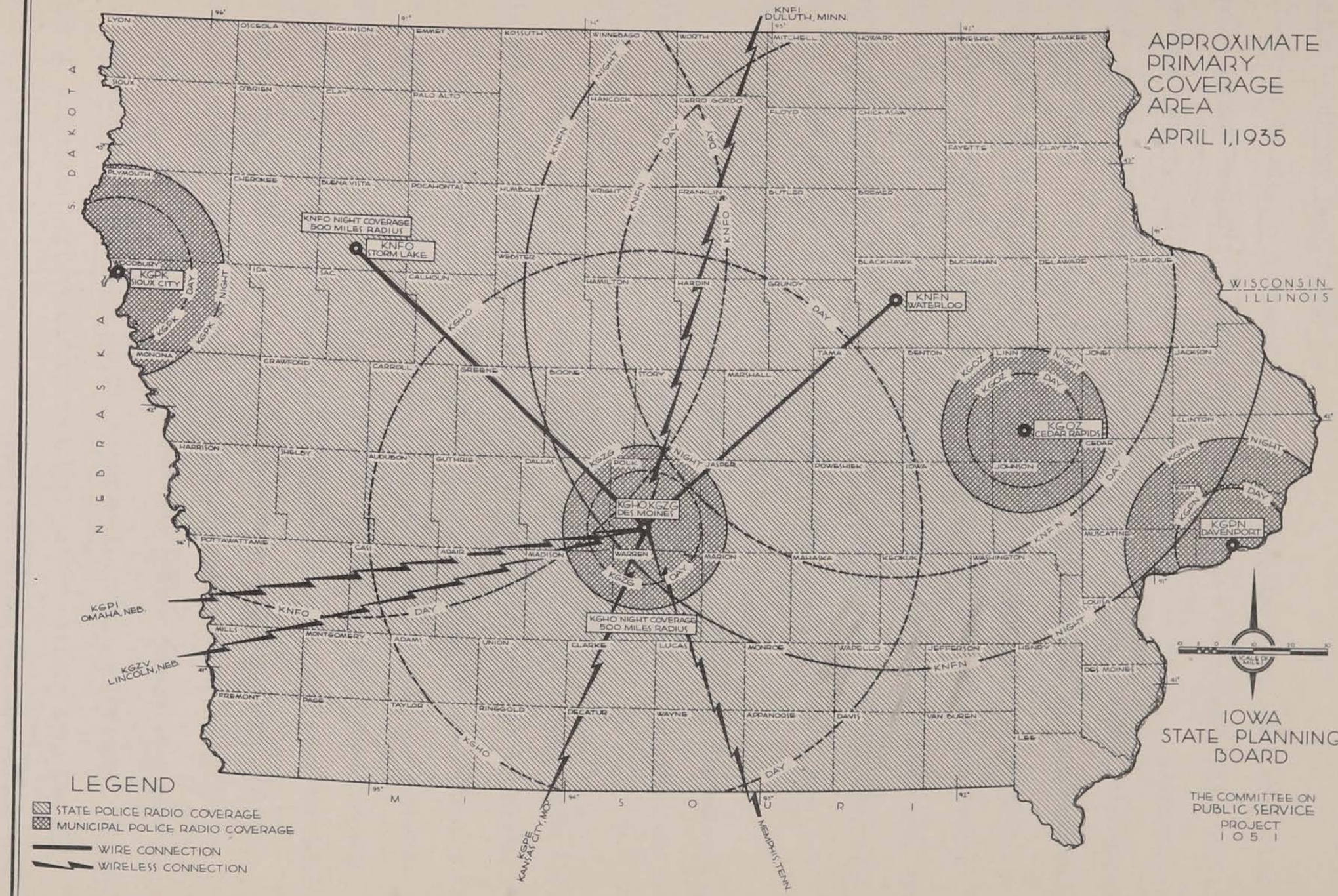
IOWA STATE PLAN COMMERCIAL RADIO STATIONS



IOWA STATE PLAN EDUCATIONAL RADIO STATIONS



IOWA STATE PLAN — POLICE RADIO STATIONS



LEGEND

- STATE POLICE RADIO COVERAGE
- MUNICIPAL POLICE RADIO COVERAGE
- WIRE CONNECTION
- WIRELESS CONNECTION

IOWA STATE PLANNING BOARD

THE COMMITTEE ON PUBLIC SERVICE PROJECT 1051

Radio Receiving Facilities

Iowa is ideally situated, geographically, for good radio reception, being almost centrally located from the country's major stations. With average radios, the people of Iowa can get stations on both coasts without their selection being limited by the proximity of the bunched, high-powered stations found in eastern cities. Iowa is not affected by high mountain ranges nor by large mineral ore deposits as are many other districts.

The popularity of the radio is shown by the 1930 Bureau of Census Statistics. At that time 308,448 families, or 48.5% of all families, reported owning radio receiving sets. This figure comprises 132,399, or 50% of the urban families; 64,741 or 42.5% of the rural, non-farm families; and 112,657 or 51% of the farm families.

The percentage of farmers owning radios is evidence of the value they place upon the market service, weather forecasts and entertainment which it furnishes.

A table found in the United States Census of 1930, illustrating the distribution of radio receiving sets by counties, is also of interest. This table has been presented for the rural communities of the state in the form of a map. Why are some counties so much more radio-minded than others? The table showing the distribution of radios by different nationalities may answer this question in part, but not altogether. Neither does the economic situation in particular counties wholly answer this question. Certain counties are much more advanced than others; only this we know.

By Iowa law, sheriffs' offices and city police forces must have receiving sets that will pick up the state police station messages. As yet, only 20 sheriffs' offices and 10 municipal police offices have installed such equipment, due, it is said, to the limited field of the police broad-

casting stations. With the addition of the Waterloo and Storm Lake state police stations in December, 1934, the State is now quite thoroughly covered under favorable receiving conditions. To complete the coverage, police stations have been proposed for the southwest and southeast sections of the state.

PRESENT BROADCASTING STATIONS

Commercial

The accompanying map of broadcasting station coverage areas is much more informative than a discourse on the subject. The southern two-thirds of the state is exceptionally well covered by a number of stations. The coverage of northern Iowa by Iowa stations is augmented by powerful stations outside the state.

Although it is customary to indicate the coverage area of a station as a circle, the field area is often far from circular, and may follow one or a combination of several plane geometric patterns. These field patterns are influenced by the type and construction of the transmitting antenna, by nearby buildings and other obstructions, and by the antenna towers.

It is evident, therefore, that a station manager may be grossly misled, concerning his effective coverage area, by reports from one or two directions at much greater distances than the power and frequency of the station warrant.

Making allowances for variations in the actual field coverage of Iowa stations, it is still apparent that the state is practically covered, and that the commercial radio station has become a powerful advertising agency. Its possible service to business and industry is unquestioned.

Educational and Religious

To meet the educational needs of the radio public of Iowa, we have four

143678

TRAVELING LIBRARY
STATE OF IOWA

radio stations: WOI at Ames, WSUI at Iowa City, KWLC at Decorah, and KFGQ at Boone.

A study of the power assigned to commercial and educational stations discloses some interesting facts. Of a total of 62,750 watts daylight power allotted on Jan. 1, 1934, only 5,700 watts was to educational stations. Of 54,500 watts total night power, only 500 watts was assigned to educational stations. By March 1, 1935, daylight power to commercial stations had been increased from 57,050 watts to 58,700 watts, and night operating power from 54,000 watts to 54,550 watts. The power allotment to educational stations remained the same during this period. Educational stations were given 8.9 per cent and 0.9 per cent respectively of available daylight and night power in Iowa. The present year, 1935, is bringing further increase in allotted power to several of the commercial stations. The educational stations have had considerable trouble to maintain even their present hours, frequency and power.

Police and Aviation

At the present time there are four aviation radio stations in Iowa. Two are owned and operated by the Bureau of Air Navigation of the United States Department of Commerce. The other two are owned by the United Air Lines. The government station at Iowa City broadcasts weather and other aviation information, and gives out information and directions on call; acting as a service agency for itinerant aircraft. The radio range station at Burlington is automatic and operates continuously. A caretaker visits the station at scheduled hours during the day and night. A signal is provided to call the attendant in case of emergency.

The United Air Lines stations at Des Moines and Iowa City are used, except in emergencies, for the guidance and direction of company owned air-

craft. These stations are able to contact aircraft in their working districts, during the day, even under rather adverse conditions. At night, with different frequency, the range is increased to such an extent that contact may be made under normal conditions with company land stations several hundred miles distant.

Iowa was one of five states to pioneer state police radio stations. Three state police stations of 400 watts, and 1,682 kilocycles, are located in Storm Lake, Waterloo and Des Moines. The first station, constructed in Des Moines in May, 1933, was found to be of insufficient power to cover the state; therefore two more stations were constructed and put into operation in December, 1934. Crime bulletins and other police information originating in Des Moines are broadcast by the three State police stations simultaneously; wire connections between the Des Moines stations and the other two are shown on the accompanying coverage map.

Messages from these stations are picked up by four municipal police stations, at Sioux City, Des Moines, Cedar Rapids and Davenport, and rebroadcast for the information of local authorities. Hourly broadcast exchanges with five out-of-state police systems make the system quite effective in combating crime. Radio connections with the five out-of-state police stations are also shown on the map. Besides this out-of-state hook-up, which is extended from time to time, the state is planning an exchange of crime bulletins with still a wider territory. Appeals will be made before the present legislature for two more state police stations; one in southeast Iowa, and one in southwest Iowa.

COMMENTS AND RECOMMENDATIONS

Much of the criticism of the commercial radio station is based on the

abuse of its function as an advertising medium. While advertising is the function of most commercial broadcasting, this advertising is sold through entertainment and educational features. Recognition is now being given the fact that the radio, by its very nature, has a responsibility to the public. This responsibility is to serve the Iowa home and family as well as the sponsoring advertiser.

The more progressive stations are coming to recognize this responsibility and are making definite efforts to eliminate harmful advertising and provide better types of entertainment. But further improvement can be made, and stations should recognize and respect the fact that their programs reach people of widely varying ages and classes. The small commercial station is discovering that, by proper management and program selection, it can build up a popularity with its local audience to an even greater degree than can the large station. The large station must appeal to a widespread cosmopolitan audience, whereas the small station has a lesser variety of tastes to which it must appeal.

TELEPHONE COMMUNICATION IN IOWA

INTRODUCTION:

The telephone systems of Iowa, particularly the private ones, have suffered greatly during the depression; customers have been lost and repairs and replacements have been neglected. In 1930, the Northwestern Bell Telephone Company was operating in 157 cities and towns in Iowa, while Independent Telephone Companies operated in 778. Until the final check is made on the rural and urban surveys now in progress, no figures can be given on present services.

It is the purpose of the present State Planning Board to study to present the actual, existing conditions; the effects of the depression on the telephone industry; and, if possible, to suggest a method for restoring service, from the standpoint of both the operating companies and the people of the state seeking telephone service.

HISTORY AND DEVELOPMENT

In 1877, the first telephone was brought to Iowa by George B. Engle Jr. Mr. Engle, with a partner, D. H. Ogden, Editor of the Cedar Rapids Standard, entered the telephone business by securing a license to lease Bell telephones. Their business expanded rapidly, and they incorporated as the Hawkeye Telephone Company in 1880. They secured licenses to construct telephone exchanges in Waterloo, Cedar Falls, Fort Dodge, Independence, Muscatine, Oskaloosa, and Iowa City. Mr. Ogden in 1879, formed a second partnership with Edward T. Keim of Dubuque to erect an exchange in that town. The first private telephone exchange in the state was probably one constructed by Mr. Engle for the city of Burlington in 1878. Another early exchange was one built in Keokuk by the Western Union Telegraph Company in 1878. The Cedar Rapids exchange opened for service in 1880. This date marked the beginning of a period of rapid expansion in

the telephone industry. The fundamental Bell telephone patents expired in 1893, and within a few years almost every town and city in Iowa was served by telephone.

Iowa is now well served by a network of long distance telephone lines, reaching almost every community in the state, and connecting to world service. A number of the major long distance telephone lines traverse the state. Among these are the east and west lines from Dubuque through Waterloo and Sioux City; the central transcontinental line entering the state at Davenport, and passing through Iowa City, Des Moines and Council Bluffs; and the third from Sioux City through Mason City. Among the important north and south lines are: one south from Council Bluffs to St. Joseph and Kansas City; one north from Council Bluffs through Sioux City; one north and one south from Des Moines; one north through Cedar Rapids and Waterloo; and one south from Davenport through Burlington.

The accompanying table taken from the quinquennial reports of the telephone industry, U. S. Dept. of Commerce, Bureau of Census, is of interest in a number of respects. Note the effect of the depression on all systems other than the Bell, also the increase in the number of telephones served by the Bell system, and the decline in the number of telephones served by all other systems.

Of the population of Iowa, according to the 1930 census, 58.4 per cent is urban and 41.6 per cent rural. Of the total number of telephones in residences in 1932, 52.5 per cent are in urban homes, and 47.5 per cent in rural homes. Considering the size of families, a slightly larger per cent of telephones are found in farm homes than in urban homes. According to information disclosed in the Iowa Industrial Survey of 1930, the state stands in the front ranks in telephone development. At that time, Iowa stood first in the nation in rural telephone development, with 84 per cent of its farms reached by telephone; there was one residence phone

to every 5.3 persons - almost one to a family.

When business telephones were included, three other states surpassed Iowa in the industry. These were California with 24.2 telephones for 100 population, Illinois with 23.7, and New York with 23.3. Iowa had 23.0. The large number in the first three named states was explained by the extensive telephone utilization in the hotels and business institutions of the large cities.

In Iowa, the Bell systems serve a higher percentage of business phones, in proportion to total services than do the other systems. The Bell systems' wire miles have increased each year, while all other systems have decreased.

(From U. S. Bureau of Census Reports)

Year	Systems and Lines: Total	Bell	Other Systems & lines	Miles of Wire: Total	Bell	Other systems & lines	Central Stations: Number offices: Total	Bell	Other systems & lines
1932	3,429	---	3,429	1,310,798	1,067,019	243,779	971	169	802
1927	4,809	---	4,809	960,226	661,904	298,322	996	136	860
1922	4,897	---	4,897	757,600	453,018	304,582	961	137	824**
1917	5,223	---		650,513			1,129	214	915**
1912*	3,444	---		504,101			442	128	314**
1907	3,445	---		360,884			751	73	678**

* Not reported for systems and lines having incomes of less than $5,000.00.
**For systems and lines having incomes of less than $5,000.00 the actual number of central offices was not reported -- only the number reporting central offices.

Year	NUMBER OF TELEPHONES: Total	Residence: Rural and Urban	Business	BELL SYSTEM: Total	Residence	Business	All Other Systems and Lines: Total	Residence	Business
1932	484,879	380,463	104,416	236,485	164,388	72,098	248,393	216,075	32,328
1927	565,533	454,763	110,770	227,555	165,515	62,040	337,978	289,248	48,730
1922	533,347			177,151			356,196		
1917	489,432			195,295			294,137		
1912	380,294			116,813			263,481		
1907	332,545			52,772			279,773		

Year	Miles of wire % incr. or decr.		Telephone % incr. or decr.	
	Bell system	Other systems or lines	Bell system	Other systems or lines
1932	61.2	- 18.3	3.9	- 26.5
1927	46.1	- 2.1	28.5	- 5.1

PRESENT SERVICE

Physical Condition

Almost all the mutally owned, and a few of the small privately owned, telephone companies' lines and exchanges are in very poor condition and near the end of their service life. Many miles of lines are so corroded that splicing of broken lines is almost impossible. Few splices were ever soldered. Many poles are decayed, some are propped up, and some are hanging or lying flat. Through timbered areas, wire is ingrown into trees. Switchboards antidate the recollection of present operators; repairs in many cases, are made by the local blacksmith, or by the clumsy proddings and twistings of one of the operators, untrained in the use of tools.

The Bell Systems and the larger Independent Telephone Companies are maintaining their systems in fine condition.

Plant Improvement and Extension

With many switchboards and much physical equipment worn out and obsolete, there can be no question about the need for rebuilding. The managers of many companies have stated that they would like to replace poles, wire, cable, switchboards and other items if they had the money. There is much to be done and there will be a large market for all types of telephone equipment when economic conditions improve.

One of three things will soon take place in Iowa:-

1. Farmers or private owners will reach deeply into their pockets to build systems anew.

2. A large number of people will lose the convenience of a telephone - many have already lost their phones.

TELEPHONE - Miles of line - number of companies.

(From report of Iowa Board of Assessment and Review.)

Year	TOLL LINES		EXCHANGES		SYSTEMS		RURAL LINES		TOTALS	
	Miles of line	No. Cos.	Miles of line	No. Cos.	Miles of line	No. Cos.	Miles of line	Number Companies	Miles of line	Number Companies
1902									22,120	642
1905	1,249	12	342	75	34,588	318	18,570	1,852	54,749	2,257
1910	1,041	7	755	117	46,080	342	28,215	2,694	76,091	3,157
1915	1,086	5	594	126	51,045	377	28,880	2,585	81,605	3,093
1920	1,079	3	649	121	55,477	465	29,113	2,923	86,318	3,512
1925	1,150	3	1,172	141	55,524	423	24,569	2,521	82,416	3,088
1927	1,090	3	598	130	55,682	396	23,882	2,656	81,251	3,185
1928	893	3	647	125	56,466	376	23,830	2,668	81,835	3,172
1929	889	2	618	127	57,092	345	23,162	2,647	81,762	3,121
1930	1,562	2	604	120	57,770	333	23,455	2,700*	83,390	3,155
1931	1,880	2	562	136	59,092	335	21,671	2,663*	83,204	3,136
1932	1,865	2	412	131	59,153	338	21,552	2,530*	82,982	3,001
1933	1,866	2	252	132	59,113	338	20,985	2,450*	82,216	2,922
1934	1,867	2	251	128	58,262	335	20,727	2,436*	81,107	2,901

* Estimated number of rural companies

3. The Bell System, or other private owners, will take over the properties of the failing systems and rebuild them.

Most of the companies have reported lines on which inductive interference has been excessive at times. In most cases, these lines parallel power transmission lines. Only by metallicizing the circuits can this condition be remedied; doubtless many companies will make this improvement when conditions permit.

Some thought should be given to the proper subscriber loading of rural lines. No matter how well equipment and plant are maintained, satisfactory service cannot be given on lines with twenty subscribers. Ten phones on a line make a satisfactory load.

Personnel

Nearly two thirds of the employees of the Independent Telephone Companies are women. In many cases, a family is found to be the owner. This family manages, operates, and makes the line repairs. Similarly, for the mutually owned systems, a family takes care of the entire business. In Most cases the exchanges are kept in the homes.

The decrease in the number of subscribers has had little, if any, effect on the number of employees. Most of the companies are reporting the same number of employees that they had in 1929. Salaries, however, have been reduced drastically. In some cases, whole families are employed for $45.00 per month or less, when formerly they commanded $100.00 or more.

Quality and Extent of Service

With but few exceptions, the quality of service, on the small systems, is only fair. There are few metallic circuits outside the larger towns, and on toll lines. Almost all of the latter are owned and operated by the Bell system.

Many rural lines are overloaded. On the second or third ring, receivers come down all along the line, making it difficult to complete the call.

Subscribers have become so used to poor service that they do not realize that improvements are possible. Many farmers have ceased to pay switching fees through their mutual exchange, and yet remain on their local line. Occa sionally they do "get through" the switchboard. Such men are parasites to the system.

Eighty-four per cent of the farms of the state were reported to have service in 1930. Although the percentage for 1934 is not known, we do know that, in the southern counties of the state, almost every system has lost 40 per cent of its subscribers. The 1930 census reported one telephone for every 5.3 persons in the state. At present the ratio is likely less than 1 to 6.3.

Free Service

Most telephone companies in the state operate "free service" lines to surrounding towns. Usually each company owns half the line to the connecting exchange. In almost all cases, these lines are grounded circuits of iron wires. It frequently is possible to build up connections so that subscribers may talk through as many as thirty towns, even though the transmission, in some cases, may be so poor as to require "repeating" by the operators. Because of reciprocal relations between companies, no charge is made to subscribers for this service. Many companies have expressed dissatisfaction with these "free service" lines, but feel that they are forced to provide them because other companies do so.

One company is trying to discourage the use of these free service lines through their exchange. They refuse to give good contacts, frequently "cut off" conversation, and otherwise wilfully make such service undesirable. Customers do not understand why they cannot always have this service; they consider it a part of their rights as subscribers. The only way that this "free service" can be eliminated is through cooperative action of all companies in the Association, and even then a few customers

will be lost.

These "free service" systems really amount to toll services. If the lines were made metallic, and maintained in first class condition, charges could be made which would aid the companies in maintaining their systems.

Service Costs and Rates

Very few of the mutual telephone systems use even a semblance of method in determining rates. Rather, they have reduced rates without regard for maintenance expense, to the end that the condition of equipment precludes the possibility of rendering adequate service. Feeble and ineffectual efforts are made, by subscribers, to collect fees and repair lines.

The result of such practices is the dissipation of the original investment, with no provision for rebuilding. Consequently, if the mutual company is to maintain the service, the subscribers must be assessed to provide funds for rebuilding.

The "service-below-cost" rates charged by so many small systems has caused the rates charged by well maintained systems to appear excessive. If people would only stop to consider all the factors involved in ownership, (if people did consider, few would care to own a small telephone company) -- original investment, interest on investment, risk, collection difficulties, maintenance of service, the independence of those served, etc.; they would realize that the owner is being "pushed to the limit" by rates that he is receiving for service. We criticize the lack of maintenance, but why should one keep putting money into a losing investment? The lowest rates are considered the fairest rates; if the private owner demands a higher rate than that paid by neighboring mutual groups, the subscriber strenuously objects. He declares that the telephone is a convenience, not a necessity, and as a result, his telephone goes into a truck. The subscriber should realize that, if the telephone business were a lucrative one, services would be maintained in the best condition,

lest a competitor enter the field with better service and equipment.

The Bell Telephone Company gives good service, and maintains its equipment in fine condition. Bell customers don't break the company if rates aren't reduced to meet those charged by a mutual. Such, however, was the fate of one small company in the state. The owner, a banker, started removing phones from homes that refused to pay. The customers retaliated by making a run on the telephone owner's bank.

This criticism is not made of any individual, but of the entire service. We realize that buying power is very low, and that at present the telephone rates, even at "below cost" levels, are too high for many incomes. The horse has been stolen, but we can put a lock on the stable door before we get another horse; let's reorganize the rate system, do some rebuilding, and try to make depreciation allowances to maintain the systems. Much education will be required to make the public appreciate the justice of higher rates; some persons will refuse to pay, but in justice to the others, they will have to get along without service. It will be difficult to obtain funds for rebuilding and, for a time, to collect higher rates; but as conditions are adjusted and management improved, it should be easier.

In the past, rates charged by private companies may have been adequate. But, instead of building up reserves for depreciation and maintenance, the assets were dissipated through excessive dividends. It is unfortunate that, in many cases, systems needed rebuilding just when economic conditions were worst.

Our survey shows that rates vary between $4.50 and $24.00 a year, with $12.00 a year being the most common. Reports indicate that collections of $4.50 are almost as difficult to obtain as the higher ones. Few data on cost of service were available. Systems of accounts rarely were found. Managers start putting down estimates of costs when asked about operating

costs. Most mutual systems have no costs other than the salaries of the operators, four sets of batteries per year for the switch board, and some incidental repairs. As each line is owned by its subscribers, the mutuals rarely have reports to the State Board of Assessment and Review.

Many of the privately owned systems have the same difficulties, insofar as furnishing cost data is concerned.

Accounting Practices

Insofar as private and mutual telephone groups are concerned, an accounting system is an exception rather than a rule. For example, in a survey of three counties, averaging at least eight mutuals and two private companies, (other than the Bell), to a county, three companies were found who make a simple financial statement of receipts and expenditures. In no case was depreciation considered, although all admitted that depreciation was a fair cost. The financial statements were made more for determining rates for the ensuing year than for any other purpose.

Few managers are familiar with bookkeeping procedure, but several have expressed desires for a simple system of records and accounts. The task of making a report to the State Board of Assessment and Review is an ordeal, chiefly because of poor records. Very few, if any, of the small companies know, even approximately, the real value of their property. The managers are utterly lost, in many instances, if asked the age of a piece of equipment. Because of the meager records, there is some doubt about the actual financial condition of many companies. If customers pay their rate assessment promptly, the operators receive their small wage; if collections are slow, the operators must wait.

For two or three dollars, each manager could procure an authoritative text book on accounting procedure, with simple illustrations of accounts and financial statements. Such a text should contain a clear discussion of depreciation as a cost of operation. If sound systems are

to be maintained provision must be made for this item.

If a Public Service Commission is created, it should distribute sample sets of simple bookkeeping forms, with instructions for their use. These forms should provide all information required by the different governmental agencies; and such information should be submitted to the Commission each year on a standard report form.

The Commission also should have sole jurisdiction over rates, and should undertake to educate subscribers to an appreciation of the importance of operating costs as a basis for rate structures.

TELEGRAPH SERVICE IN IOWA

INTRODUCTION

Much of the following material on the history of telegraph development in Iowa is credited to the "Palempsest", Volume 6, November 1925, pages 373-393, organ of the Historical Society of Iowa.

There is much doubt as to who was the first inventor of the telegraph, but to Samuel F. B. Morse goes the credit of inventing the first practicable instrument, and of devising the alphabet in universal use today. In 1835, Morse conceived the telegraph, and in 1837 was able to exhibit his apparatus. His patent was received in 1840. The first line was constructed between Washington and Baltimore, a distance of 40 miles, by a Congressional grant of $30,000. The first message was sent on May 24, 1844. During the session of 1844-1845, Congress made an appropriation of about $8,000.00 to maintain the system during the year, and placed the line in charge of the Postmaster General.

On the following year, the government declined to give further assistance, and refused to purchase the Morse patents for $100,000.00; thus the telegraph reverted to private hands and has remained so. The growth of the business has been attained by much competition and rivalry.

HISTORY AND DEVELOPMENT

As to the entrance of telegraph service into Iowa, we quote two short passages from the "Annals of Iowa".

"Democratic Enquirer", July 4, 1848. -- "By Lightning. As the post holes for telegraph are completed to Bloomington (Muscatine), we shall, probably, be able to give our readers 'News by Lightning' in the course of two or three weeks."

"Democratic Enquirer", August 19, 1848. -- "Two large coils of telegraph wire were landed here this week. Certainly many more days cannot intervene before we are in communication with the cities of the Union."

"On August 28, 1848," states the Palempsest, "the Burlington Hawkeye reported that the telegraph was put in operation for the first time yesterday between this town and Bloomington (Muscatine), and we had the pleasure of conversing with our friends up stream by lightning. Next week we hope to be in communication with St. Louis and the eastern and southern cities".

This exchange of compliments between Burlington and Bloomington may not have been the first messages transmitted in Iowa, for on August 17 the "Hawkeye" contained an item to the effect that Dubuque and St. Louis had already "exchanged compliments by lightning". This statement is at variance with the generally accepted record that the first telegram received in Dubuque was on September 15, 1848.

Henry O'Reilly, a newspaper man of Rochester, New York, was the father of western telegraph. He promoted more than 25 thousand miles of lines, including the first that crossed the Alleghany Mountains and four distinct lines touching the Mississippi River. Capital necessary for construction was obtained through sale of stock, as was to be expected, but most of this stock was wiped out in reorganizations and consolidations.

The companies had great difficulty in maintaining service over the early lines. For the first few winters, the lines were out of service more than half the time. Great wooden masts were employed to carry the wires across the large rivers. The largest mast on record was one built at Paducah, Kentucky; over 60 feet across at the base and 307 feet high, the mast stood on a 32 foot bank. The masts were almost $\frac{3}{4}$ mile in span; the wire was No. 16 iron wire, weighing 63 pounds per mile, and was strung to be at least 100 feet above the water at its highest stage. Naturally these masts succumbed to the elements. Too, passenger pigeons settled on the lines in such numbers as to break them down.

The early lines followed the streams and roads. Over much of the territory traversed, there were no roads to follow in maintenance and con-

struction. The equipment that had to be transported was none too light. The electromagnet in first use weighed 185 pounds.

The early instruments were crude affairs. All messages were embossed on a narrow strip of paper and read by touch. Some wide-awake hangers-on of these early stations discovered that they could decipher messages to some extent by the sound of the instruments; thus a new school of sound operators was founded, who were able to read messages with much simpler apparatus. The old operators soon found themselves without jobs, for, strange as it seems, they were unable to master the sound machines.

The total messages transmitted over the Illinois-Iowa wire in September 1848 was in excess of two thousand, which was double the number of messages of the preceding month. Many of these messages were gratuitous news messages furnished by the operators, anxious to popularize the telegraph and to secure personal favors for themselves. However, news agencies were soon organized and editors had to pay for dispatches. By an advance payment of $6.00 per week, any club or person could secure the news of the day. This service was very popular with saloons and cafes.

From the time of patenting, 1840, to the time that the government relinquished the telegraph, in 1845, it was only three years until Iowa had telegraph service. Soil was not turned for the first railroad in Iowa, the M and M, until September 1853. The third general assembly, in 1851, passed a ruling to allow the use of the highways as rights of way, and to allow rights of way across private property upon the adequate payment of damages, for telegraph systems. But the telegraph did not advance as fast as was hoped. From 1850 to 1860 the business disintegrated rather than increased, service being too uncertain.

A line reached the state capitol in Iowa City some time in 1851. On December 23, 1853, Burlington was connected with Chicago. By 1853, the railroads were beginning to radiate out of Chicago in every direction, and

the telegraph companies abandoned the policy of following the rivers and roads, and began to follow railroad routes.

In 1856, a new line up the Mississippi River competed for a time with the Western Union, but eventually all Iowa towns were being served by the most universal service. In 1856, Hiram Sibley and Ezra Cornell organized the Western Union Telegraph Company through consolidations, and most lines were taken over by them within a decade.

The later development of the telegraph followed the development of the railroads, which, after 1860, made rapid strides. The use of phantom circuits, teletype, and other modern instruments, has increased manyfold the service rendered over the wires.

COMMENTS AND RECOMMENDATIONS

The accompanying table shows the extent of telegraph lines in the state of Iowa, since 1902, as reported to the State Board of Assessment and Review. It will be noted that the total miles of line and the number of serving companies is slowly decreasing. More business is being conducted yearly through the use of telephones. Of the five companies serving, three are railroad owned systems; the other two companies are the Western Union and Postal Telegraph.

Year	Miles of Line	Number of Companies	% of Total reported by W.U. & P.T.
1902	9,800.51	8	88
1905	9,070.35	5	96
1910	10,566.00	9	92
1915	10,324.82	6	84
1920	10,367.00	6	84
1927	10,176.32	6	84
1928	10,169.01	6	84
1929	10,169.39	6	84
1930	10,158.03	5	84
1931	10,125.05	5	84
1932	10,131.23	5	84
1933	10,044.29	5	87.5
1934	10,042.62	5	87.4

This survey has found that many communities are without service, except by telephoning to an open office. The railroads have discontinued their agents in many small towns. The sending of messages is complicated by the fact that few of the locally managed telephone systems charge telegraph bills to the telephone account.

In some towns, special agents have been appointed with whom messages may be left for sending. However, very few people have taken advantage of this service in spite of the fact that it is provided for their convenience.

Most of the smaller towns of Iowa are served only from the railroad depot. Usually the agents day is one of eight hours. After hours, telegraph messages must be telephoned either way from a 24 hour service station. If a message is to be sent out of town after the agents' hours, the agent either is good enough to reopen, if he can be located, or there is a telephone toll to the town that has a 24 hour service. This is to be expected. In the case of prepaid messages, however, coming into the rural community when the local agent is not available, the message is phoned collect from the nearest 24 hour station to the recipient. We believe this to be an unfair practice and should be corrected.

GAS SERVICE IN IOWA

INTRODUCTION:

Although gas service is not as extensive as electric service in value of plant and equipment, gross revenue, or population served; it is becoming one of the major home service industries.

Gas is classified into six main types or kinds, namely: Natural, water, coal, butane, mixed, and tank gas.

HISTORY AND DEVELOPMENT:

Gas was discovered many years ahead of electricity, and preceded it by some years as an illuminant. Price, to a large extent, prohibited the use of gas for heating purposes. The old gas systems were neither convenient nor clean. Naturally, with the advent of more economical electric service with its greater availability and convenience, the small gas systems throughout the state deteriorated and passed out of existence.

Later, after more economical methods of producing manufactured gas were devised, plants were built or rebuilt and systems planned so that this gas could be made available for domestic and commercial use. For heating, gas is probably more extensively used than electricity, and is still used to some extent in lighting.

With the advent of natural gas into the state in 1930-1931, the gas industry in Iowa was given great encouragement. A large number of cities and towns heretofore unserved were reached, and many using manufactured gas were changed over. Gas service, in most instances, was reduced in cost, and could be used economically for house heating, industrial firing, etc.

The following is a summary of the present gas service in Iowa:

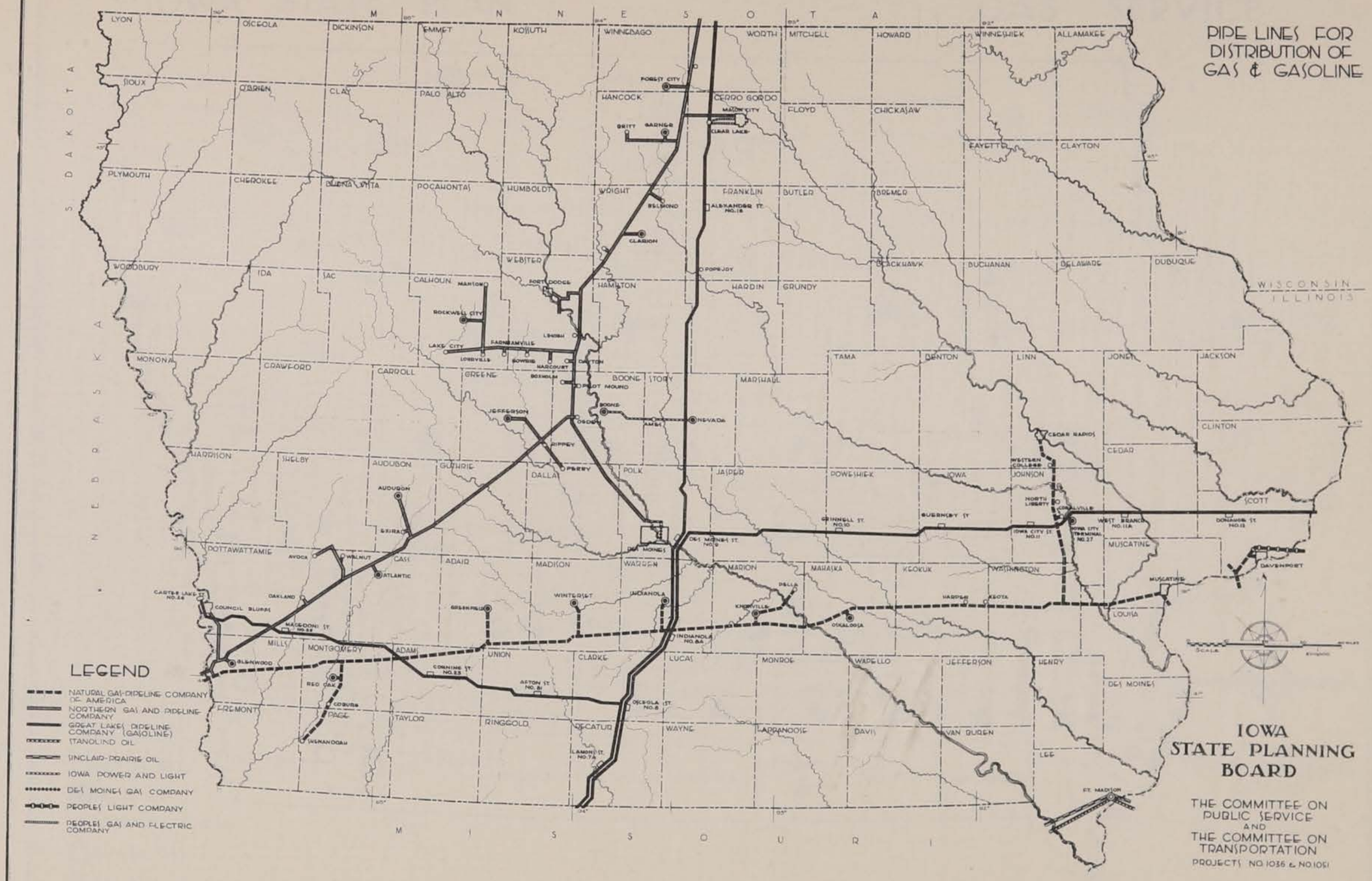
March 1, 1935

Number of towns having gas service	95
Total population of towns having gas service	971,928

IOWA STATE PLAN

PIPE LINES

PIPE LINES FOR DISTRIBUTION OF GAS & GASOLINE



LEGEND

- NATURAL GAS PIPELINE COMPANY OF AMERICA
- NORTHERN GAS AND PIPELINE COMPANY
- GREAT LAKES PIPELINE COMPANY (GASOLINE)
- (TANOLIND OIL
- (INCLAIR-PRAIRIE OIL
- IOWA POWER AND LIGHT
- DES MOINES GAS COMPANY
- PEOPLES LIGHT COMPANY
- PEOPLES GAS AND ELECTRIC COMPANY

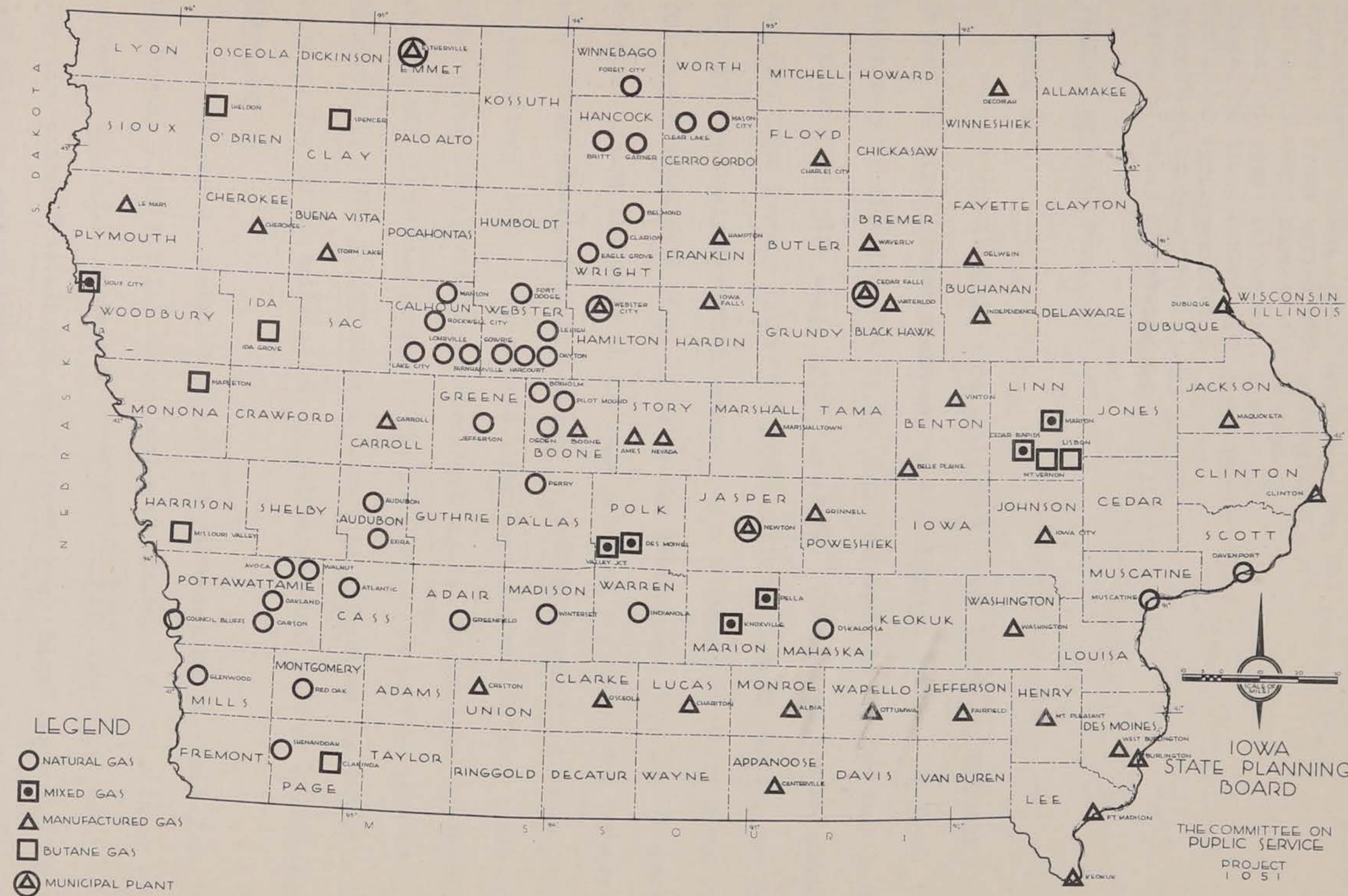
IOWA
STATE PLANNING
BOARD

THE COMMITTEE ON
PUBLIC SERVICE
AND
THE COMMITTEE ON
TRANSPORTATION
PROJECTS NO 1036 & NO 1051

1036-10

IOWA STATE PLAN

GAS SERVICE



LEGEND

- NATURAL GAS
- MIXED GAS
- MANUFACTURED GAS
- BUTANE GAS
- MUNICIPAL PLANT

IOWA STATE PLANNING BOARD

THE COMMITTEE ON PUBLIC SERVICE

PROJECT 1051

Total urban population of state	1,444,214
Percentage of urban population having gas service available	67.3
Number of towns served with manufactured gas	40
Number of towns served with natural gas	40
Number of towns served with butane gas	8
Number of towns served with mixed gas	7
Number of incorporated towns in state	934
Percentage of towns having gas service	10.2
Number of miles of natural gas pipe line in state	881

PRESENT SERVICE:

Natural Gas

Natural gas is drawn from wells in Kansas, Arkansas, Oklahoma, and Texas; and piped, under pressure, to distribution points. In Iowa, these pipes vary in size from the twenty four inch main to the two inch lateral. Two natural gas pipe lines cross the state. The line of the Northern Gas and Pipe Line Company enters the state south of Council Bluffs, and runs in a northeasterly direction crossing into Minnesota north of Mason City. The second large pipe line, owned by the Natural Gas Pipe Line Company of America, enters the state at the same point as the first, and crosses the state in an almost straight easterly direction, leaving the state just south of Muscatine. Both of these main lines have numerous lateral leads and meter sites for serving local towns and cities. A complete, up-to-date map showing all pipe lines in the state, is included as part of this report. On August 1, 1934, 308.72 miles of pipe line extensions and laterals were proposed for future building, at an estimated total cost of $2,000,000.

Mixed Gas

"Mixed gas" is a mixture of natural gas which has a high B.T.U. (approximately 1,050 B.T.U.) content and a manufactured gas of a lower B.T.U. content. The B.T.U. content of mixed gas normally runs about 800, and is therefore somewhat hotter than manufactured gas. Mixed gas generally is used where the serving company, before the advent of natural gas, was operating a gas manufacturing plant. By utilizing existing equipment, the

service company can provide some of the benefits of the high B.T.U. content of natural gas, and, at the same time, guarantee continuous service. If pipe line service fails, straight manufactured gas, with approximately the same heat value as mixed gas, can be furnished, although at a much greater cost.

Manufactured gas

Two kinds of manufactured gas are used in Iowa. Of the two, water gas is of lower quality and cheaper. Water or producers gas is produced from coal, and is made for local distribution only. Coal gas of higher B.T.U. content also is produced from coal, but by a somewhat different process. These two types of gas have been most common in the state because plants could be developed as individual units, producing gas for local distribution. However, we do have two comparatively short pipe lines transporting manufactured gas to other towns and cities for local distribution. Much of the field formerly served by manufactured gas is now served by the newer natural gas pipe lines. There are three municipal, manufactured gas plants in operation in the state.

Butane gas

Butane gas is often called "bottled gas" because it is shipped from the oil well and refinery districts in railroad tank cars, under pressure sufficient to keep it in liquid form. After being mixed with the proper amount of air, it is distributed locally through a central system, as are the other types of gas. This type of gas has become increasingly popular the past few years. Because of the small amount of equipment required, Butane gas fills a need in the smaller communities which, as yet, do not have available natural gas. Eight towns in Iowa were being served with Butane gas in 1934.

Individual tank gas

Tank gas is that supplied to the individual consumer in steel cylinders. This gas is available to any user, irrespective of location, as it does not require an extensive central plant or distribution system. The use of tank gas in the rural and suburban communities is increasing, but it is difficult to estimate the exact extent of its present use. No data for this type of equipment were included in our survey.

COMMENTS AND RECOMMENDATIONS:

No public or private agency in Iowa keeps detailed information on gas service and industry, so available information is limited. The files and records of the individual operating group contain much of the information needed by the survey, but such information is not always obtainable. Because of the fact that there is no public body having specific authority to gather such information, and because of the fear of disclosure of certain vital information by the individual companies, a complete gas survey is difficult.

Data on construction of pipelines and proposed extensions were furnished by the Railroad Commission.

At the present time, some 317.4 miles of natural gas pipelines have been proposed, and permits granted by the Railroad Commissioners. Actual construction will depend upon future financial recovery, and assurance by governmental authorities that such properties will be allowed to exist in the years to come. The companies who propose to build the lines, at an estimated cost of more than $2,000,000. will not invest their money in projects which they may not be allowed to operate.

We feel that the Federal Government should establish some policy by which private utility companies may judge the future of the industry. Unless

some assurance is forthcoming, they cannot be expected to develop their properties and extend such services as natural gas to the people of Iowa.

Such a development program, directly or indirectly, would employ hundreds of men and help dozens of other industries.

INTRODUCTION

While Iowa is primarily an agricultural state, its economic development is, to a large extent, dependent upon the availability and use of a cheap power for running its factories, operating its machinery and lighting its homes. If the majority of Iowa housewifes are to be relieved of much unnecessary drudgery, power and home equipment must be available at costs within reach of the average income.

The activities of the present administration have aroused public interest in electric service. Widespread publicity has been given to the efforts of such government agencies as the Tennessee Valley Authority, the Federal Power Commission, and the Electric Home and Farm Authority, to secure low energy rates and to promote the distribution of low cost electrical equipment. The use of low cost electrical equipment is a problem in itself. The public has been educated, partially, to the fallacy of using low cost light bulbs, with their higher operating costs and impaired efficiency; and now comes agitation for low cost appliances, tempting the manufacturers to use low grade materials, and the distributors to import foreign-made products. There is a real need for low cost appliances, but such appliances must lend themselves to economical operation.

Low rates are of even greater concern, but, up to the present time, no specific project has been promoted in this state. Much suspicion and criticism in the state today is caused by a lack of appreciation, by the public, of the factors involved in "good service". The public must be made to realize that the cost of Iowa service is determined by Iowa conditions, and not by conditions in other states.

HISTORY AND DEVELOPMENT

Power Sources.

Most of the urban population of Iowa is supplied by power plants

located within the state.

The accompanying table of present electric generating stations in Iowa shows 170 separate power plants available for service, with an average capacity of about 3,570 Kw. Of these stations, 31 are hydro, 59 steam, 66 oil engines, 11 combined oil and steam, 2 hydro and oil, and 1 hydro and steam. Omitting the Keokuk project, we have an average kilowatt capacity of 2,790 Kw.

The average capacity of the active municipal plants is 921 Kw, the steam plants averaging 1,790 Kw, the oil engine 474, and the hydro 1,432. The hydro figures largely are made up of the two municipal plants at Fort Dodge and Ottumwa, which are used for city purposes only.

(Municipal Plants)

ELECTRIC GENERATING STATIONS IN IOWA
March 1, 1935

(Municipal Plants)

Type of Plant	ACTIVE			STANDBY			EMERGENCY		
	No. plnt	Total Kw Capacity	Av. Cap. of Plant	No. Plnt	Total Kw Capacity	Av. Cap of plnt	No. plnt	Total Kw Capacity	Av. Cap. of plant
Steam	16	28,647	1,790	2	533	267			
Oil Engine	39	18,463	474	1	132	132			
Oil & Steam	4	5,668	1,420						
Hydro	3	4,295	1,432						
Sub total	62	57,073	921	3	665	222			
(Private Plants)									(Private Plants)
Steam	24	332,419	13,850	9	26,753	2,973	8	16,460	2,060
Oil Engine	21	14,323	681	4	380	95	1	370	370
Oil & Steam	7	10,793	1,540						
Hydro (including Keokuk)	28	143,078	5,110						
Hydro (excluding Keokuk)	(27)	(8,078)	(299)						
Hydro & Steam	1	2,288	2,288						
Oil & Hydro	2	1,205	603						
Sub total (incl. Keokuk)	83	504,106	6,070	13	27,133	2,085	9	16,830	1,870
Sub total (excl. Keokuk)	(82)	369,106)	(4,500)						
GRAND TOTAL (incl. Keokuk)	145	561,179	3,870	16	27,798	1,736	9	16,830	1,870
GRAND TOTAL (excl. Keokuk)	144)	426,179)	(2,980)						

Total of 170 Plants --- 605,707 Kw. Capacity --- Average plant capacity 3,563.

U. S. BUREAU OF CENSUS - CENTRAL ELECTRIC LIGHT AND POWER STATION REPORTS.

Commercial Plants

YEAR	No. of Plnts	STEAM TURBINES: No. units	H.P.	Ave. H.P.	% of Total	STEAM ENGINES: No. units	H.P.	Ave. H.P.	% of Total	INTERNAL COMBUSTION: No. units	H.P.	Ave. H.P.	% of Total
1932	122	74	355517*	4800*	64.9	71	21502*	303*	3.9	62	20018*	323*	3.6
1927													
1922	116	58	98352	1690	32.4	123	37145	302	12.2	45	3997	89	1.3
1917	182	30	40681	1356	16.8	139	32870	236	13.5	99	3839	38.8	1.6
1912	159	14	16547	1182	26.0	216	39394	182	61.7	29	1183	40.8	1.9
1907	141	2	1500	750	4.1	196	31168	159	85.3	9	398	44.2	1.1
1902	131	--	----	---	0.0	191	30714	161	91.7	5	400	80	1.2
Municipal Plants													
1932	58	21	22300*	1062*	42.9	30	7236*	241.2	13.9	94	17334*	185.5*	33.4
1927	62												
1922	72	8	4566	571	17.3	87	16527	190	62.7	59	4507	76.5	17.2
1917	143	4	2374	593	11.2	92	14740	160.3	69.3	59	3412	57.8	16.0
1912	64	1	400	400	3.0	77	11103	144.1	83.0	23	1475	64	11.1
1907	51	--	----	---	0.0	70	9238	132	94.6	2	166	83	1.7
1902	38	--	----	---	0.0	46	5876	127.8	100.0	--	---	---	---
Total Commercial and Municipal													
1932	180	95	377817*	3978*	62.9	101	28738*	284.5	4.8	156	37352*	239*	6.2
1927			373271				46589				23047		
1922	188	66	102918	1557	31.1	210	53672	255.6	16.2	104	8504	82	2.6
1917	325	34	43065	1268	16.3	231	47610	197.5	18.0	158	7251	45.9	2.8
1912	223	15	16947	1130	22.0	293	50497	172.2	65.5	52	2658	51.1	3.4
1907	192	2	1500	750	3.2	266	40406	152	87.2	11	564	51.3	1.3
1902	169	--	----	---	---	243	36590	150.6	93.0	5	400	80	1.0

* Figures are for kilowatts capacity instead of horsepower, as for other years.

The Hydro figures for 1917 - 1932 includes the Keokuk Dam; causing a radical change in the presentation of the electrical growth through the various types of prime movers used in the state of Iowa. In January 1935 the total horsepower of the Keokuk turbines was 154,420; generator K.V.A. 135,000.

U. S. BUREAU OF CENSUS - CENTRAL ELECTRIC LIGHT AND POWER STATION REPORTS (cont)

Commercial Plants

YEAR	HYDRO				TOTAL PRIME MOVERS				000's Output in Kw hrs.	Output in Kw hrs.	Output per Capata	H.P. per cap.	Appr. Ave. Load Fact.
	No. Units	H.P.	Ave. H.P.	% of Total	No. units	H.P.	Ave. H.P.	% of Total					
1932	69	151367*	2190*	27.6	276	769563	2783	91.3	1402843	1822.9			.208
1927						601913							
1922	78	164816	2113	54.1	304	304310	1001	92.0	825462	2712.5			.309
1917	86	165133	1921	68.1	354	242533	685	92.0	593888	2448.7			.279
1912	55	6639	120	10.4	314	63763	203	82.7	57191	896.9			.102
1907	41	3478	84.8	9.5	259	36544	141.1	78.9	30387	831.5			.095
1902	31	2399	77.4	7.1	227	33513	147.6	85.1	30211	901.4			.103
Municipal Plants													
1932	13	5095*	392*	9.8	158	73446	465	8.7	80253	1092.8			.125
1927						46894							
1922	4	747	188	2.8	158	26347	166.8	8	33080	1255.5			.143
1917	6	745	124	3.5	161	21271	132	8	20921	983.5			.112
1912	3	390	130	2.9	104	13368	128.2	17.3	9975	746.2			.085
1907	3	355	118	3.7	80	9759	122	21.1	7342	752.3			.086
1902	--	---	---	---	46	5876	127.8	14.9	6295	1071.3			.122
Total Commercial and Municipal													
1932	82	156462*	1910*	26.1	434	843009	1945	100.0	1483096	1759.2	599900	.340	.201
1927		205900				648807		100.0	1429170	2200	589000	.267	.251
1922	82	165563	2020	50.1	462	330657	716	100.0	858543	2591	356000	.137	.296
1917	92	165878	1801	62.9	515	263804	512	100.0	614809	2330	259000	.111	.266
1912	58	7029	121	9.1	418	77131	184.5	100.0	67167	870	29500	.034	.099
1907	44	3833	87.1	8.3	339	46303	136.5	100.0	37729	815	17050	.021	.093
1902	31	2399	77.4	6.0	273	39389	144	100.0	36506	928	16400	.018	.106

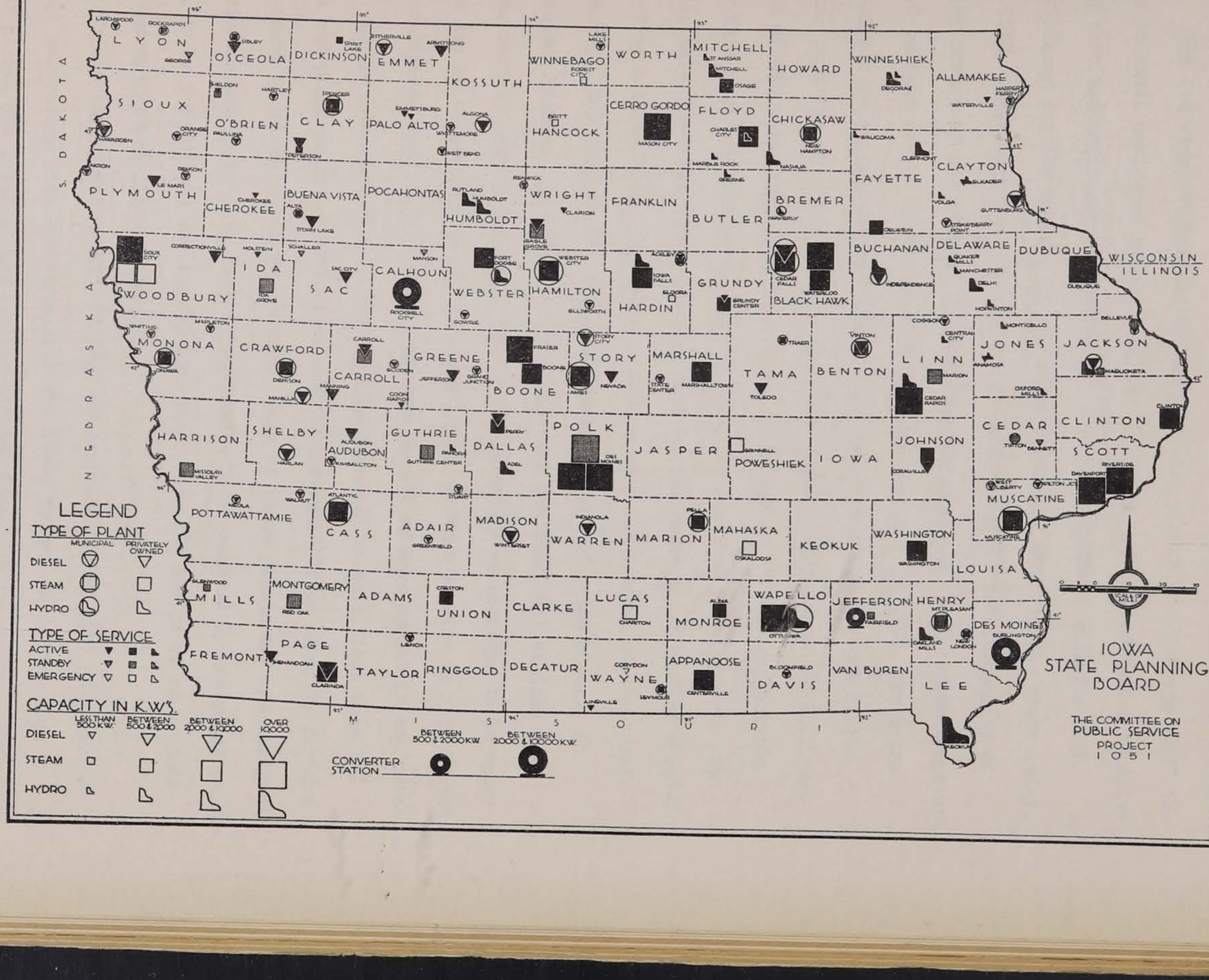
The average capacity of the active private company plants is 6,070 Kw., the steam plants averaging 13,850 Kw, the oil engine plants 681, and the hydro 5,110. Omitting Keokuk, the average capacity of the hydro plants is only 299 Kw.

The average of all hydro plants (excluding Keokuk) in the state is 400 Kw. They are almost negligible when compared to capacity and output of other sources of power.

Most of the generating stations in Iowa are small, there being only 14 plants of more than 10,000 Kw. capacity. The stations owned and operated by the private companies are connected to high voltage transmission systems. The municipal plants, with about six exceptions, have no transmission line connections, and so must have sufficient capacity for both active and standby service. This extra capacity causes lower operating efficiency and higher operating costs. The fixed charges on additional capacity are also great.

The U. S. Bureau of Census, in 1932, reported 180 electric generating stations, with an average plant capacity of about 3,330 Kw. (See accompanying table.) Less than 11 percent of these plants had capacities of over 5,000 Kw., and approximately 65 percent had capacities under 1,000 Kw. Of these 180 separate generating stations, 35 were hydro, 80 were steam, 60 were oil engines, 4 were oil and steam, and 1 hydro and oil. These stations operated at average plant capacity factors of 56.5 percent for hydro, 18.5 percent for steam, and 16.3 percent for oil engines. These figures indicate the type of service which the various plants offer. Hydro plants are operated at the maximum capacity possible at any time. Steam plants generally operate as main units, with comparatively few such plants being held as standbys ready for active service. In 1932, the Diesel or oil engine plants were operated mostly as standbys on large systems, or were being operated by municipalities where the load factor was dependent upon

IOWA STATE PLAN ELECTRIC GENERATING STATIONS



local consumption.

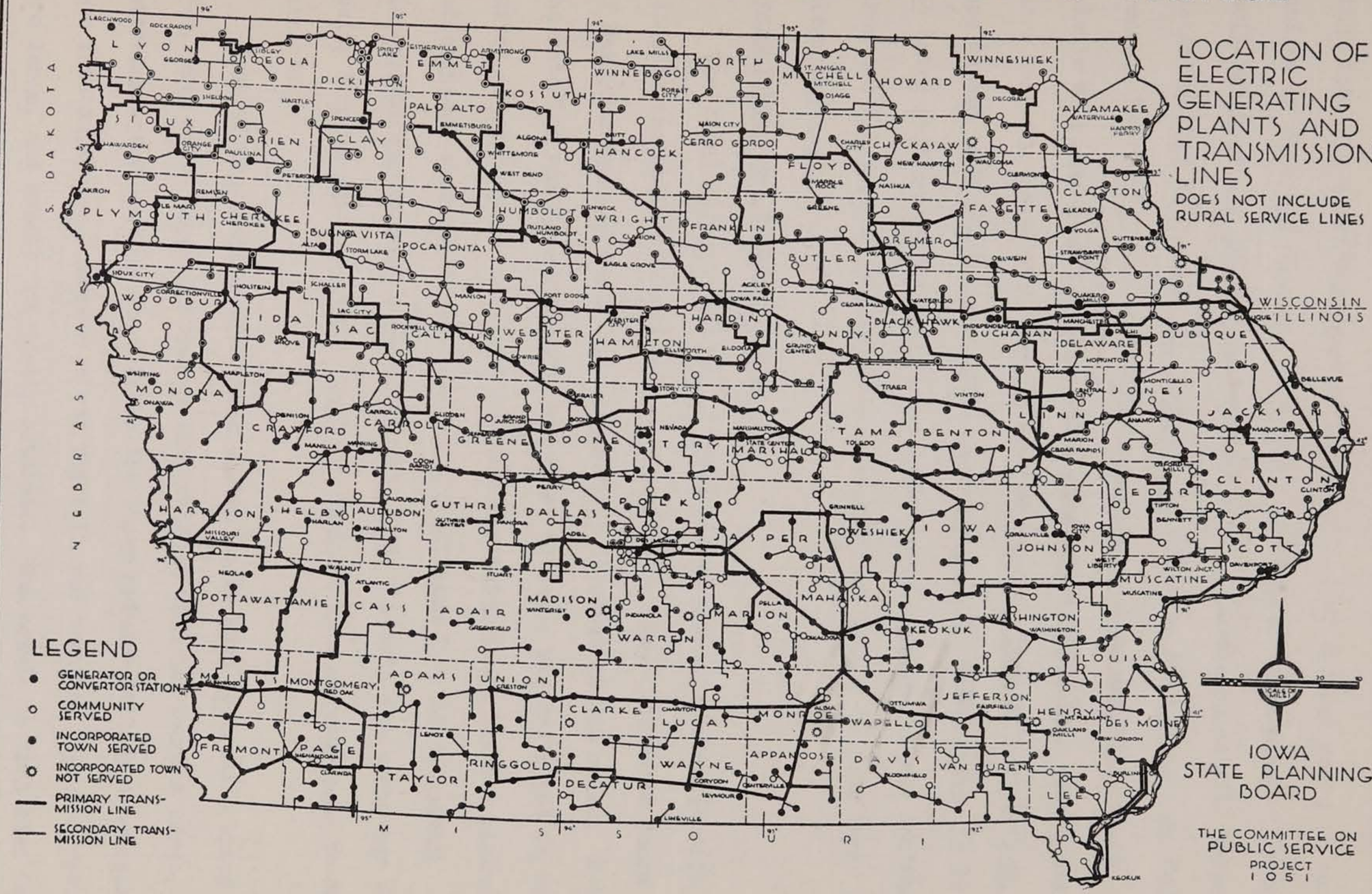
The old steam engine is becoming antique, although a few are still in use in small municipal establishments. The high cost of operation is driving such equipment out of existence. The steam turbine, with its high efficiency and low upkeep, is the major source of power in the state today. In 1932, steam turbines comprised 62.9 percent of the total capacity of prime movers in the state. In 1902, the now obsolete steam engine comprised 93.0 percent of the total capacity of prime movers. In 1902, the hydro plant was relatively insignificant, comprising only 6.0 percent of the total capacity of prime movers. In 1932, hydro plants comprised 26.1 percent of the total capacity. The plant at Keokuk is largely responsible for this high percentage in capacity of hydro electric prime movers. To date, this plant has installed only half of its capacity of turbine wheels. Omitting Keokuk, hydro plants now comprise only 2.6 percent of the total capacity. Oil engines are the most prominent type of prime movers, in municipal plants. In a few of the commercial stations, oil engines are being used as main units, but, they are held mostly as standbys to be operated two or three hours a day for peak loads, or when service is interrupted. These figures suffice to show the present trends of development in equipment.

In the municipal generating stations surveyed to date, less than 14% have had plant capacity factors of over 20 percent. Often capacity factors are found to be as low as 10 percent. Many of these plants are not designed to accommodate local load conditions, having been promoted by equipment salesmen, or by individuals who had little concern for the design of an economical energy-producing establishment.

We are submitting a map, showing the location, type, size and service of all generating stations throughout the state today. Each year some small plants are retired, and service secured from high tension transmission lines from large central stations.

IOWA STATE PLAN

URBAN ELECTRIC SERVICE



At the present time, it can be said, without fear of contradiction, that Iowa has sufficient generating capacity for several years to come unless an abnormal increase in energy consumption takes place. In most well-balanced and properly maintained plants, obsolescense will surpass deterioration as a cause for replacement of units during the next few years. Particularly is this true among the smaller municipal steam plants where much of the equipment is more than 15, and in some cases, more than 20, years old. Faulty engineering, or lack of engineering, has caused much waste and inefficiency in electric generation. It is to be noted that municipal plants are much slower in adopting new equipment than are the private companies; a few still are loathe to junk their old steam engines.

Transmission and Distribution Lines

The total number of miles of transmission and rural distribution lines in the state is not known at the present time. The State Board of Railroad Commissioners has estimated it at about 12,000 miles. Using the material the Public Service Division, to date, has collected in its survey of such lines, we would estimate the total to be between sixteen and eighteen thousand miles. At the present time Iowa has no agency responsible for keeping such information. As a result the state may be losing a great deal in taxes; specific examples have already come to our attention.

Most of the transmission lines in the state have been built since 1914, with major expansion during the twenties when the present large, inter-connected systems operated by the large private utility interests came into existence. Expansion was rapid in the twenties because profits were large, and credit was easily obtained. The result is that Iowa is now covered with a vast network of transmission lines, built, apparently, with no regard for the positions of the companies concerned. The accompanying

ELECTRIC SERVICE
(U.S. Bureau of Census Reports)

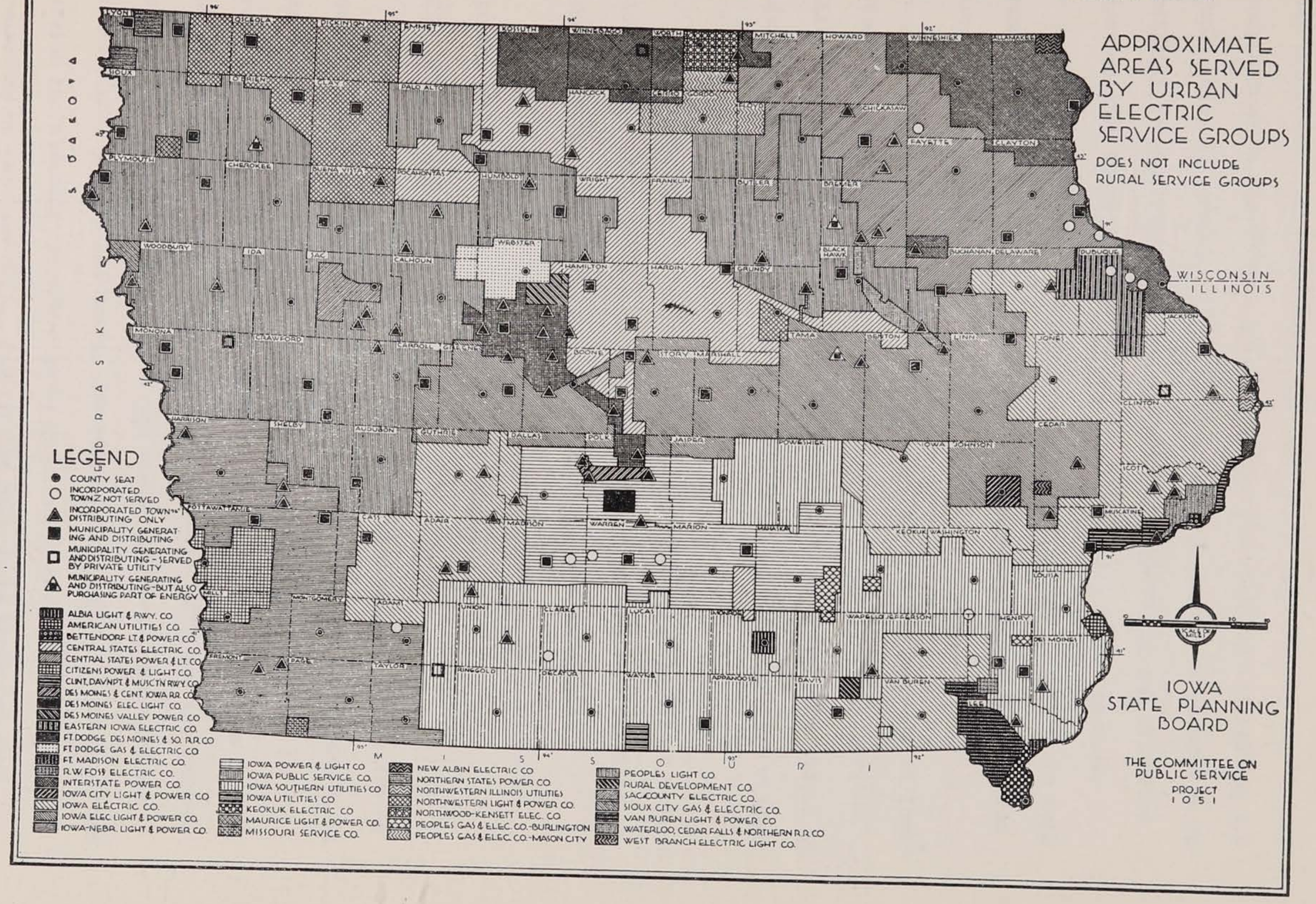
SERVICE	IOWA		MINNESOTA		MISSOURI		NEBRASKA		KANSAS	
	1932	1927	1932	1927	1932	1927	1932	1927	1932	1927
Population (000)	2,479	2,425	2,585	2,686	3,656	3,510	1,388	1,396	1,894	1,828
Total customers	459,455	411,684	483,011	413,440	655,083	589,543	235,491	178,832'	334,247	254,137
FARM SERVICE										
No. customers	18,438	9,335	9,874	2,041	10,720	2,374	5,770	1,322	8,098	5,743
Ave.Kwhr - cust.	708	442	826	561	691	303	787	601	1,130	1,022
Ave. $ - custo.	71	52	74	50	46	22	74	48	65	56
¢ per Kwhr	10.1	11.7	9.0	8.9	6.6	7.1	9.4	7.9	5.7	5.5
DOMESTIC SERVICE										
No. customers	372,753	326,751	388,664	341,266	535,615	490,167	190,667	145,925	270,723	201,474
Ave.Kwhr - cust.	525	336	613	415	651	423	613	435	578	382
Ave. $ - custo.	35	30	35	31	32	26	35	31	32	26
¢ per Kwhr	6.6	8.8	5.7	7.4	4.9	6.1	5.7	7.1	5.5	6.8
COMMERCIAL LT. & SMALL POWER										
No. customers	64,066	71,618	66,800	54,862	104,255	69,080	35,780	24,673	50,100	38,229
Ave.Kwhr - cust.	3,173	2,362	3,125	2,642	4,153	4,386	3,456	2,998	2,631	3,175
Ave. $ - custo.	130	123	133	135	164	176	141	128	119	124
¢ per Kwhr	4.1	5.2	4.3	5.1	3.9	4.0	4.1	4.3	4.5	3.9
COMMERCIAL POWER WHOLESALE										
No. customers	4,378	19,053*	17,673	*	4,493	27,922	3,274	6,912"	5,326	8,691
Ave. Kwhr - cust.	62,552	42,726*	25,164	*	141,379	20,842	43,737	18,932"	55,451	29,042
Ave. $ - custo.	910	662*	423	*	1,896	401	652	400"	802	593
¢ per Kwhr	1.5	1.5*	1.7	*	1.3	1.9	1.5	2.1"	1.4	2.0

* Minnesota included with Iowa

" Nebraska included with North and South Dakota

' The total includes the wholesale power customers in North and South Dakota, approximately 4,400 customers.

IOWA STATE PLAN — URBAN ELECTRIC SERVICE



map illustrates this fact very well. In their mad rush for new business, many companies, paralleled existing lines with resultant litigation and duplication of service. This condition will gradually be changed as rebuilding becomes necessary, and the companies operating the extensive systems plan their program for greater economy and better service.

On the whole, the transmission lines throughout the state are well connected, and all major cities and plants have service available from several directions.

Electrical service has been made available to the majority of Iowa communities within the last 20 years. In 1916, 415 towns had service. This number was more than doubled by 1930, when 899 towns were listed as having service. Today only 15 of the 934 incorporated towns are without service.

Four municipal plants in Iowa generate and distribute direct current electricity. Service from these plants is not satisfactory as standard appliances cannot be used, and distribution is more difficult.

A number of communities receive 25-cycle energy, which requires special appliances, generally at greater costs.

Urban and Rural Service.

A study made of electric service in the five mid-western states of Iowa, Minnesota, Missouri, Nebraska, and Kansas, as taken from the U. S. Bureau of Census reports, shows that total electric consumption is increasing yearly. There is an increase not only in kilowatts per customer but in the number of customers using service. Iowa has the largest total of rural customers of any of the states mentioned, and also the greatest cost per unit of energy according to the table. Domestic urban service has steadily increased as to total customers and steadily decreased as to cost per unit. Iowa is the only state mentioned that lost small commercial customers because of the depression. Costs of this

service have steadily declined. Wholesale commercial power customers have declined very materially as to number of customers, but consumption per customer has increased. The cost per unit of energy has varied but slightly on this group of consumers. Iowa seems to favor commercial business on the costs of service.

Organization and Financial Structure of Electric Service Groups.

There are but few private companies serving in Iowa that are not affiliates or subsidiaries of some holding or super-holding company. At present, March 1935, forty-two different private corporations or companies are listed as serving the incorporated towns of Iowa. These companies may be classified as seven main groups, each group consisting of subsidiaries, operating under one management; and several small companies or individual private owners serving a minor part of the state. These seven main groups may be designated as the United Light and Power, the Iowa Southern Utilities Company, the Sioux City Gas and Electric Company, the Interstate Power Company, the Des Moines Electric Light Company, the Cedar Rapids group, and the Citizens Power and Light Company. Most of the companies in these groups are incorporated under Delaware, New Jersey, or New York law, although a number of them are Iowa owned and operated. Within the groups, the different subsidiaries are held in close relationships through interlocking directorates.

In Iowa, these subsidiaries have been acquired in various ways. One of the favorite methods of gaining control has been to purchase securities in the subsidiaries of other companies, then quietly making exchanges of stocks until control of the desired companies was obtained. A number of the present, existing, operating companies have been built up through purchases and combinations of numerous smaller companies. During the past few years, some companies have had to turn over large blocks of shares to outside moneyed interests in refinancing projects. The shares are demanded as

security or outright gift. The public utilities, being in no position to bargain, are forced to comply. In some instances, the finance organizations also hold large interests in equipment enterprises and force these subsidiaries to invest heavily in equipment which they do not need. Frequently, it is sub-standard equipment which the finance companies are anxious to unload, and for which repairs are not obtainable. To protect themselves, the subsidiaries are forced to make the public pay the bills.

The private utility companies in Iowa, unquestionably are financed at excessive interest rates. The average interest paid by the Iowa companies on bond and note issues was, in 1932, 5.62 percent; and for the five year period, 1923-1932, 5.30 percent. The maximum interest permitted was 8 percent and recently has been reduced to 7 percent. Those companies most conservatively managed were able and did finance in better times, and secured interest rates as low as 3 percent for a period of time. Those who were forced to refinance in the depression years have suffered. In the past few years, it has been almost impossible for a private utility to refinance, regardless of the interest rate. For example, one company, in excellent financial condition, and having paid its preferred stock dividends, was forced, when it refinanced in 1932, to receive 6½% first mortgage bonds through a bonding house at a refinancing charge of 7% over a five year period. This brought the money rate to 7.9%. It is almost impossible, in the face of present day conditions, to earn such a high rate.

The Iowa operating companies are financed in several different ways. In general, each company has a common stock carrying voting powers; in many cases this stock, except the directors' qualifying shares, is held by the parent company. Usually, there is one or more types of preferred stock, and various types of notes and bonds. Preferred stocks may be cumulative or non-cumulative, voting or non-voting; except that in most

cases, non-payment of dividends on cumulative stock gives it voting rights.

A study was made of the methods used in financing the municipal plants and systems in present operation. The results of this study, insofar as data were available, are as follows: (102 Municipal systems, originally financed thus)

52	financed and paid for by taxation	------51%
10	financed jointly by taxation and earnings	------ 9.8%
2	financed by local contributions	------ 1.9%
1	gift to the city	------ 1.0%
19	financed by earnings	------18.6%
18	indefinite - in a number of cases general obligation bonds were issued	------17.7%

Those municipal plants built in the past three or four years have all been financed out of earnings, as provided in the Iowa Simmer Law. In the state today, we have a number of municipal establishments taxing property for the payment, and in some cases, for the operating of the municipal utility. We also have a number of others which, besides rendering some free service to the community, are turning large annual contributions into the city's general funds and into other departments for tax reductions. There is a point at issue in this method of financial juggling. If the municipal system has been paid for by taxation, it now belongs to the tax payers of that community, and not to the subscribers, who, in many cases, are not the same people. Likewise, if the system has been paid for by earnings, assuming it has rendered free service in lieu of taxes, it belongs to the electric consumers of the community, and all benefits should revert to them in lower service rates. In general, however, municipal finances are in such condition that very little is known about them. Often, bond issues have been refunded until their origin is unknown. Municipal financing, fortunately, has been at a very favorable rate of interest, and, generally over a long period of years. Most interest rates on municipal securities are between 4 and 5½%.

In a number of the municipalities still taxing for the payment of

their utility establishments, we find below average service rates, which is, in reality, "flying under false colors".

Every municipal plant is a law unto itself; there is no regulation from without to compel the municipality to make an annual balance sheet, produce a certain percent of profit, or provide for the future by depreciation accountancy. There is no cooperation between municipals for the purpose of solving common problems.

At the time of the 1932 election, an amazing number of towns changed light superintendents. Unfortunately these superintendents are appointed by the mayors. In one or two cases, the town paid for the mayor's choise; politics in municipal industry is fatal. Very few municipal governments have availed themselves of the trustee form of control over their municipal industries.

PRESENT SERVICE

Quality and Extent of Service

Electricity is available to 99.9 percent of the urban population of the state, and, except for isolated cases, the service is satisfactory.

A few towns have very poor distribution systems; and a few, because of bad location or poorly planned lines, have frequent interruption of service. However, most towns have two-way or three-way service, and so are protected against such interruptions.

Only a few small municipal plants generate direct current; almost all equipment is designed for alternating current and serving companies furnish this type.

Service Costs and Rates

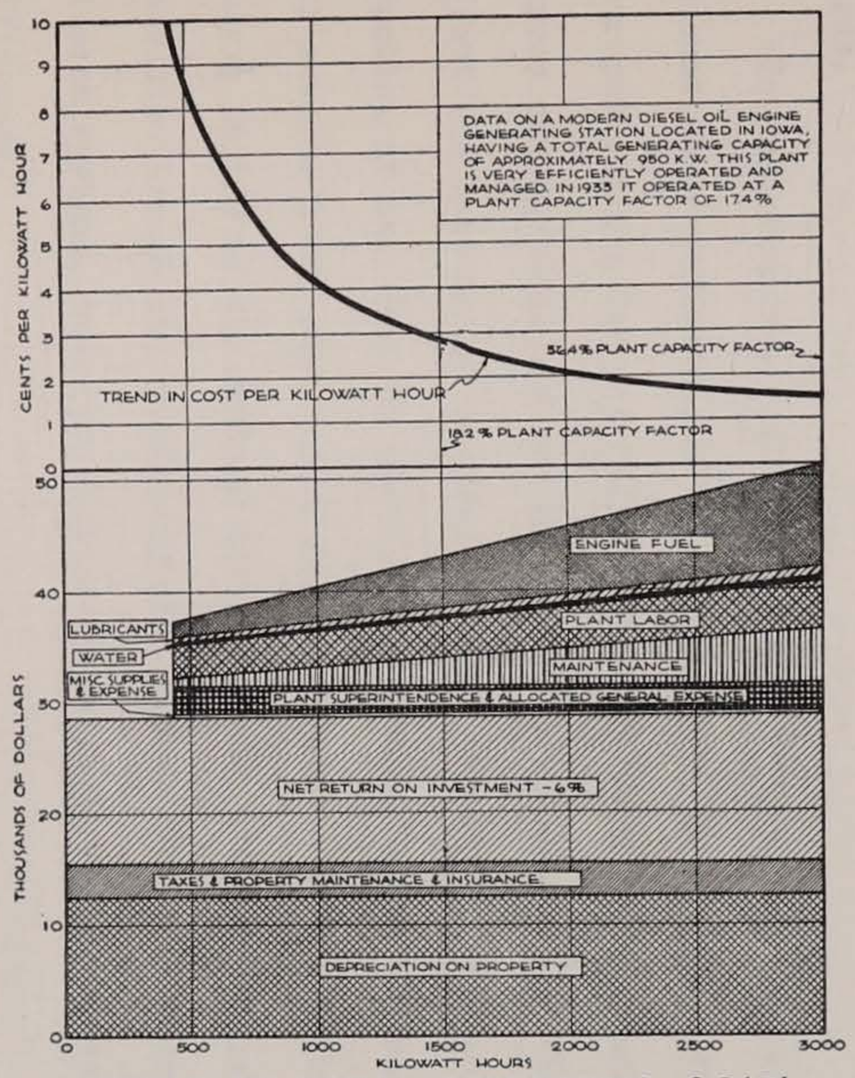
Perhaps no single question in the electric industry causes more discussion than that of electric service costs and rates. Few consumers realize what factors are included in cost of service, or appreciate the value of such services in modernizing industries and homes. Not until interruptions

occur is service really appreciated. The public fails to realize that energy is almost always at its command, for the trouble of pressing a button or turning a switch. During the last thirty years, the electric service industry has grown by leaps and bounds, until today electricity is so commonly used that it is hard to visualize the time when we did not have it available in our urban homes. During those thirty years, progress has been made in the generation, transmission, and distribution of such service; costs have been lowered time after time, and service has been improved. All this has been accomplished by hundreds and thousands of individuals working and striving to improve service, and with that, increase business and profits for the groups they served. Thus we find that years of labor by thousands of engineers and scientists, together with investments aggregating millions of dollars, have made our present fine electric service available.

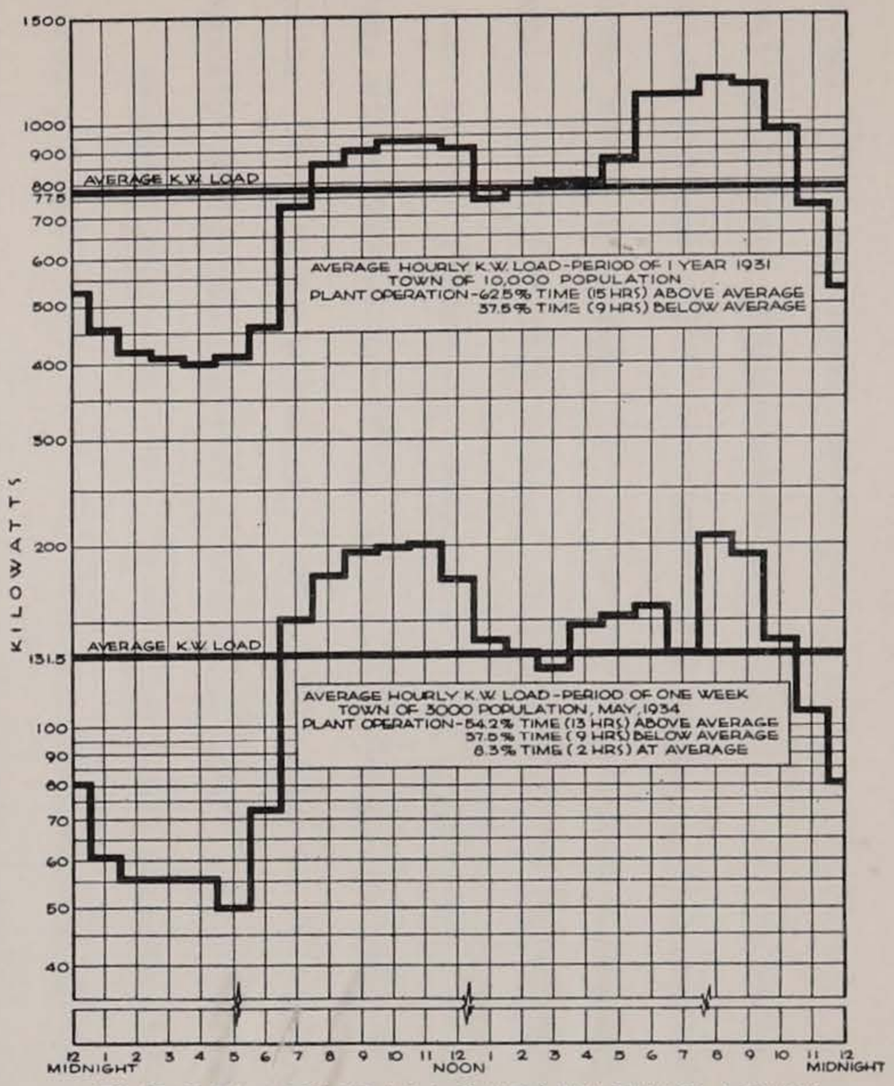
The costs of rendering electric service to the ultimate consumer can be classified into three distinct sections:

1. Generation costs

Generation costs are those which go to make up the cost of producing energy, ready for transmission or distribution. Such costs are: Fuel, superintendence, labor, water, lubricants, maintenance, miscellaneous supplies and expenses, allocated general expenses, taxes and insurance, depreciation on physical property, and net or fair return (often called profit). The accompanying chart shows these costs as they exist in a typical Iowa oil engine generating station of about 950 kilowatt capacity. In size, this plant compares very favorably with the average Iowa municipal plant of 921 kilowatts. The curve at the top of the chart shows the trend in total generating costs per kilowatt-hour output with the total output of the plant. This chart would indicate that the lowest possible cost per kilowatt-hour that reasonably can be expected for this plant is $1\frac{1}{2}¢$ with the plant operating



TREND OF TOTAL GENERATING COSTS WITH VARYING OUTPUT*



TYPICAL HOURLY LOADS IN TWO IOWA COMMUNITIES**

NOTES

* THIS CHART WAS PREPARED TO ILLUSTRATE THE MANY COSTS WHICH ENTER INTO THE PRODUCTION OF ELECTRICITY IN AN IOWA OIL ENGINE GENERATING STATION OF ABOUT 950 K.W. CAPACITY.
AVER. CAP. OF MUNICIPAL PLANTS - 921 K.W.
" " " PRIVATE UTILITY - 6070 K.W.
" " " ALL PLANTS - 3670 K.W.
LESS THAN 10% OF THE GENERATING PLANTS OPERATE AT PLANT CAPACITY FACTOR OF OVER 25%

** SHOWING FLUCTUATIONS AS THEY ACTUALLY OCCUR

IOWA STATE PLANNING BOARD

TOTAL ELECTRIC GENERATING COST AND KILOWATT DEMAND CURVES

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at approximately 35 percent. Thus we readily see why it is important to have an economically designed generating plant with a high plant capacity factor. Most engineers agree that a plant operating as a unit should have about 50 percent additional capacity for standby purposes, so it would seem that 50 percent plant capacity factor would be the ultimate figure. Our survey shows that very few of the municipal plants operate at more than 20 percent plant capacity factor. Private utility companies try to maintain a much higher figure for their main plants, perhaps reaching 50 percent or over, since there are other plants to carry on in case of emergency or peak loads. Utility text book writers often refer to 30 to 40 percent plant capacity factor as the most universally found in central plants.

Standby plants are located in some towns because the franchise requires a plant within the city limits. It would be cheaper for the company to have auxiliary steam turbines in the central station to carry the peak loads.

To emphasize the reason for low plant capacity factors, we are including kilowatt-hour demand curves for two typical Iowa towns, over a twenty-four hour period; one for a yearly average, the other for a weekly average. These curves clearly show how the habits of the consumers and the appliances used affect the load on the system. We can see how the generating plant must be capable, at any time, of meeting the demands of the system and yet be allowed for several hours each day or night to operate at a very low load, perhaps only $\frac{1}{4}$ to 1/3 of the maximum daily demand. A large diversity factor, made possible through the connecting of a number of separate communities by transmission systems, makes for better plant loads and increased operating efficiency.

In analyzing the generation costs, we find that fixed charges, depreciation, taxes, and net return make up a major portion of the total costs,

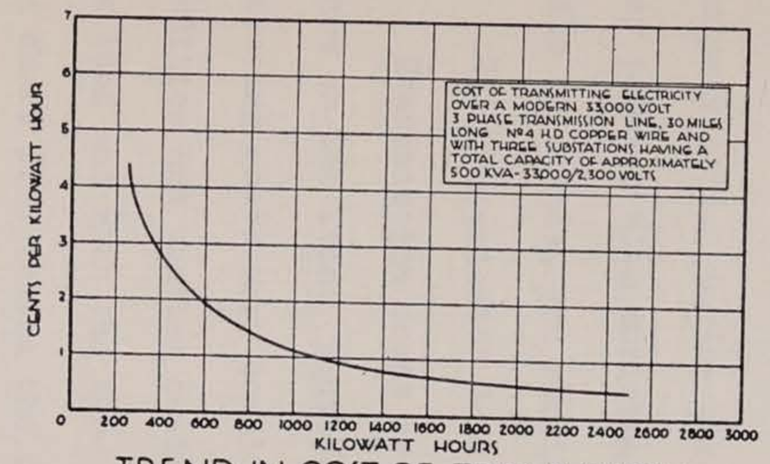
and do not vary with output as do the other costs. When operating at about 18 per cent capacity factor, the plant has a total generation cost of about $42,000, of which 67 per cent is fixed cost; at 35 per cent capacity factor, the total generation cost is about $51,000, of which only 57 per cent is fixed. These fixed charges are costs which in many cases are neglected or forgotten. This particularly is true in municipal establishments where the property has been paid for out of earnings or taxes. In such cases depreciation is neglected except as capital items are replaced. They are exempt from property taxation except as free service is rendered. The net return item is generally neglected except where payments and interest are still due on their property.

Thus we find that, if fixed charges are neglected, operating costs often represent as low as $\frac{1}{4}$ of the total generation costs.

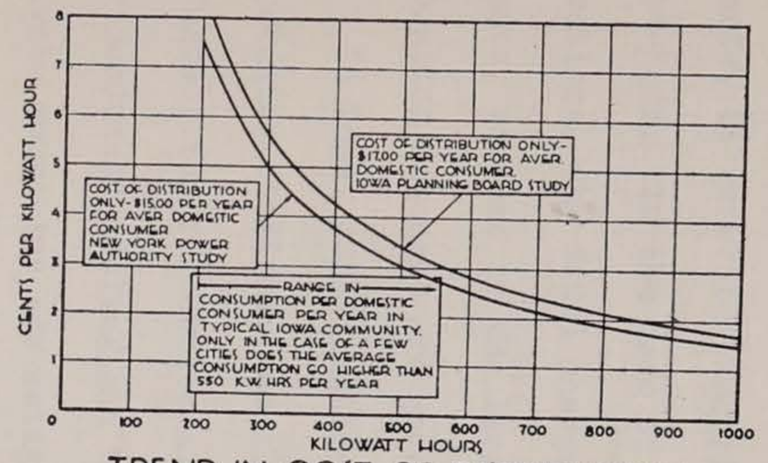
The actual operating costs of those plants already surveyed have not been completely analyzed and prepared, but in general we find a very wide variation. This variation is caused by size and types of plants, the condition and age of equipment, the type and amount of load, and the ability of the management. Costs are not as low as certain individuals would lead the public to believe. These individuals do not always include all the costs. They generally neglect fixed charges which make up a major portion of the cost of generating electricity.

The total costs of placing a kilowatt-hour on the switchboard of the plant under discussion can be reduced to $1\frac{1}{2}¢$ only when operating at a 35 per cent plant capacity factor, about $0.0085 of each kilowatt-hour output being fixed costs.

The total generation costs with smaller plants are generally materially higher than those shown in this discussion, as fixed charges rise and operating efficiency becomes lower. As the size of the units or plants become



TREND IN COST OF TRANSMISSION



TREND IN COST OF DISTRIBUTION
WITH VARYING CONSUMPTION PER DOMESTIC CONSUMER

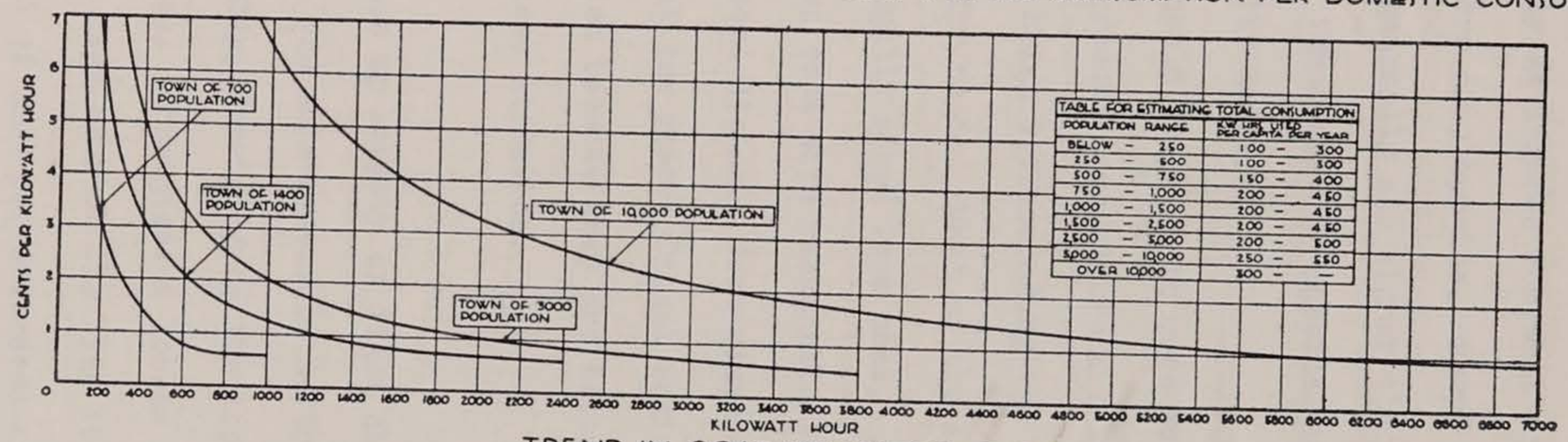


TABLE FOR ESTIMATING TOTAL CONSUMPTION	
POPULATION RANGE	K.W. HR. USED PER CAPITA PER YEAR
BELOW – 250	100 – 300
250 – 500	100 – 300
500 – 750	150 – 400
750 – 1,000	200 – 450
1,000 – 1,500	200 – 450
1,500 – 2,500	200 – 450
2,500 – 5,000	200 – 500
5,000 – 10,000	250 – 550
OVER 10,000	300 – —

TREND IN COST OF DISTRIBUTION
IN TOWNS OF VARYING SIZE AS INFLUENCED BY THE
TOTAL KILOWATT HOURS SOLD TO CONSUMERS PER YEAR

IOWA STATE PLANNING BOARD

TRANSMISSION & DISTRIBUTION COSTS PER K.W. HOUR DELIVERED

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larger, the total costs become less by inverse reasoning. It undoubtedly is possible in Iowa, with large, modern, superheated, high pressure steam plants, to generate electricity at figures somewhat under a cent per kilowatt-hour. In the case of hydro developments, except in very favorable locations, the fixed charges generally are higher than in steam and oil plants, because of the larger investment in physical plant. However, the operating expenses are generally lower.

In Iowa, consideration should be given to more super-power, mine-mouth generating stations. At the present time, there are several plants so situated, their location also being influenced by the available water supply for condenser cooling and boiler needs. Most of the large steam plants of private companies are using locally mined Iowa coal. A few of the larger municipal plants are using Iowa coal with reasonable success, while the small steam plants and those some distance from mines are using Illinois and Kentucky coal. During the last ten years, Diesel engine plants have become very popular with municipalities because they are better adapted to small units or plants, and require less attention.

2. Transmission Costs.

Transmission costs are made up largely of fixed charges, including taxes on the lines, equipment, and substations or switching facilities. Operating costs vary considerably, depending on the location and physical condition and weather conditions. Transmission losses vary somewhat with the load and with the type and condition of the line itself. The accompanying chart illustrates the trend of cost per delivered kilowatt-hour over a high quality modern transmission line, (33,000 volt, 3-phase, #4 H.D. Copper wire), with three substations totaling about 500 Kv-a capacity. The curve seems to indicate that under favorable load, transmission costs can be expected to reach about $\frac{1}{2}\phi$ per killowatt-hour delivered.

In computing the fixed charges for transmission, we have used interest at 6 per cent, depreciation at 4 per cent, and other costs as they actually occurred.

3. Distribution Costs.

The Public Service Division has attempted, wherever possible, to gather information and data concerning distribution costs of electricity in urban communities. This subject has received very careful study by various governmental agencies during the past year, particularly by the New York Power Authority.

Much of the data collected by the Public Service Division have not been completely tabulated and analyzed; in most cases it has not been possible to collect data in such a way as to compute distribution costs separately.

The report on cost of distribution of electricity, as made by the New York Power Authority, allows 2.5 cents per kilowatt-hour as the cost of distributing energy in that state; and the cost of generation, transmission, and distribution as 3.5 cents per kilowatt-hour. This New York report is based on an average residence consumption of 600 kilowatt-hours yearly, of which Iowa has very few. Editors, in commenting on this report, quote the 2.5 cents without mentioning the 600 kilowatt-hours per year upon which it is based. In using this figure, the Power Authority of New York State quotes that the approximate cost of distribution to the average domestic customer is $15.00 per year.

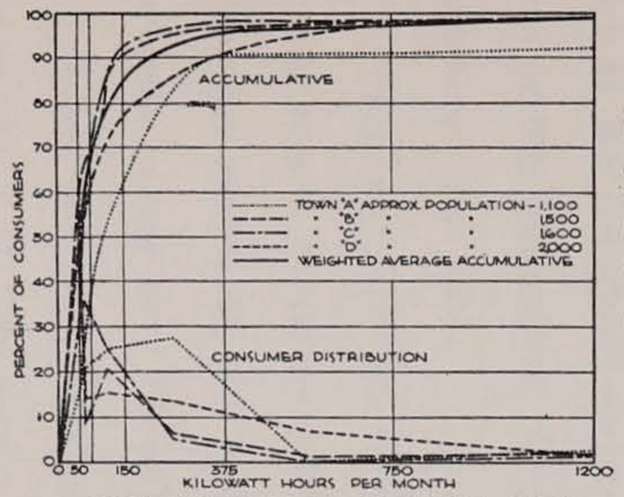
Our surveys indicate that the distribution costs in Iowa are somewhat higher than those indicated by New York; the average cost to all consumers being about $21.00, depending somewhat upon the size of the community served. For domestic consumers, the cost is somewhat less, or about $17.00 per year. The higher cost for distribution in Iowa may be attributed to the higher

investment per customer served. The above costs do not include generation costs.

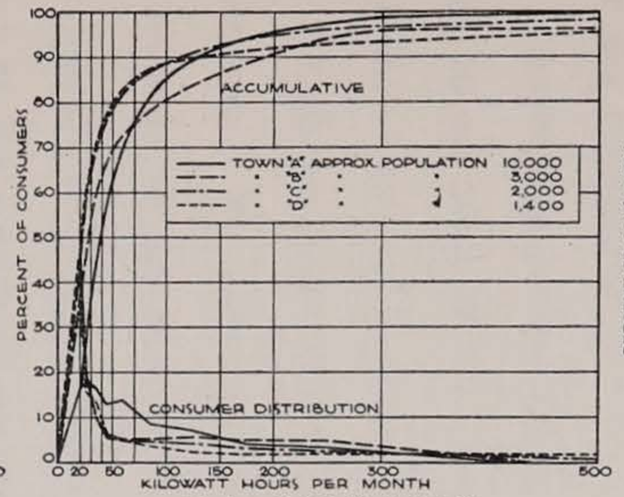
These costs were found to exist when considering all pertinent factors and allowing 6 per cent for interest and 4 per cent for depreciation. One cost which is very hard to estimate, but which is of increasing importance to the serving groups, is that caused by theft on the part of some consumers. Some groups estimate that they receive compensation for only 90 per cent of the energy delivered. Another cost which must be considered by the private utilities, but not by the municipal establishments, is the 3 per cent federal excise tax. This seems an unfair discrimination, for which the public pays.

In studying the cost of distribution to the Iowa domestic consumers, two curves have been prepared to show the relation of the cost of distribution per kilowatt-hour as it varies with the annual consumption of the customer, using the $15.00 and $17.00 yearly cost. These curves clearly demonstrate the importance of high consumption if low cost distribution is to be expected. Thus, we find that distribution costs are not 2, 3, or 5 cents per kilowatt-hour but vary with the amount of energy consumed by each consumer, in that such costs are almost entirely fixed and exist whether he uses 200 or 1,200 kilowatt-hours per year.

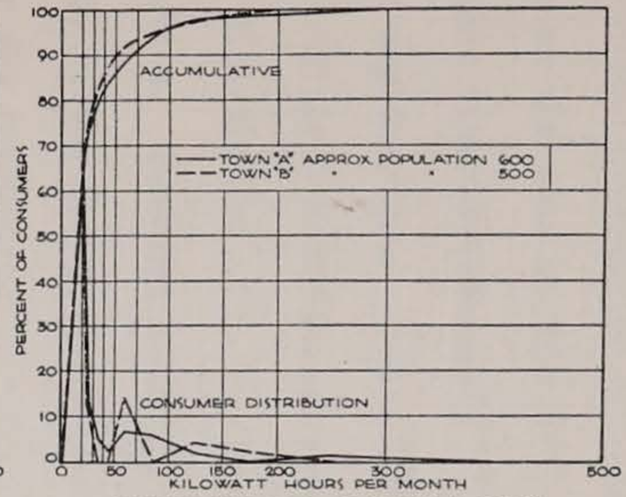
In addition to the above curves, a special study was made of four representative towns for which accurate distribution costs were available. These towns had populations of 700, 1,400, 3,000, and 10,000. The curves were based on the total consumption of electricity by the town, and the total cost of delivering a kilowatt-hour under varying per capita consumption. The range in consumption per capita for each population range was based on the consumption figures of a large number of towns in each range. The wide range demonstrates the great variation in the amount of electricity used by



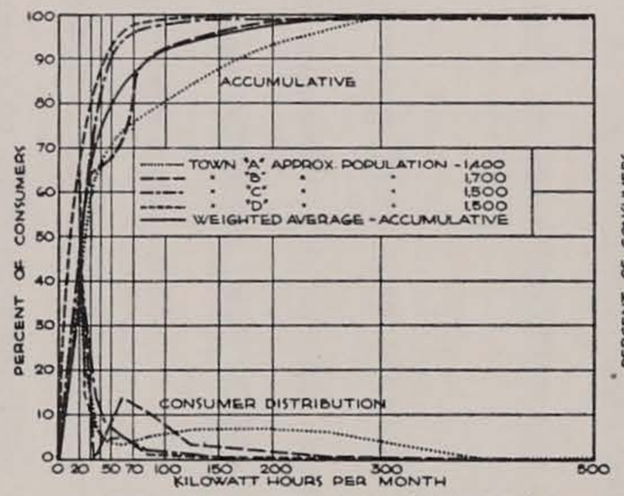
COMMERCIAL CONSUMERS



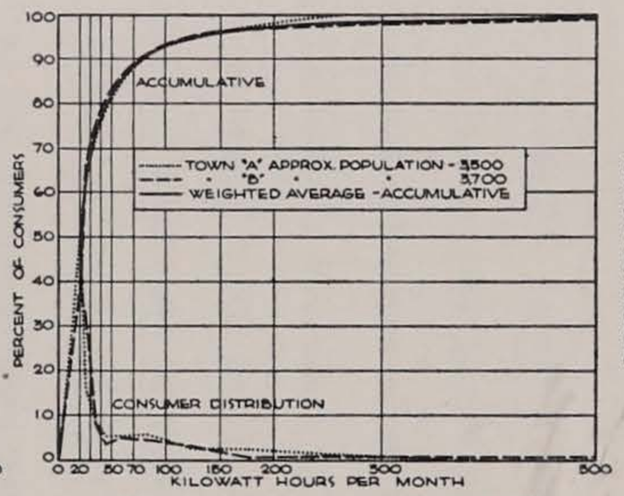
ALL CONSUMERS



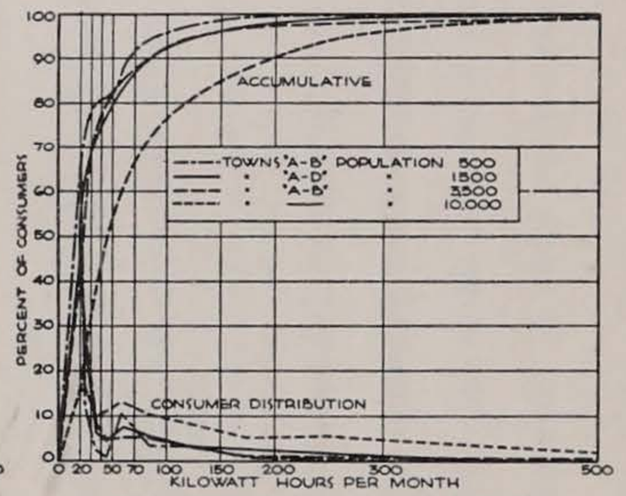
RESIDENCE CONSUMERS



RESIDENCE CONSUMERS



RESIDENCE CONSUMERS



RESIDENCE CONSUMERS

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URBAN ELECTRIC CONSUMER DISTRIBUTION CURVES

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different communities. Using these curves, we find that for the same kilowatt-hour consumption per capita the distribution costs vary somewhat according to the size of the town. These curves seem to indicate that we can expect distribution costs to reach about 0.6 cents per kilowatt-hour with a per capita yearly consumption of 1,000 or more kilowatt-hours.

Since the amount of energy consumed is so important a factor in the cost of distribution, let us study the extent to which Iowa people use electric service. Consumer distribution curves are submitted for towns of about 500, 1,500, 3,000, and 10,000 population for the two types of consumers and for all consumers.

Referring to the accumulative curves for domestic consumers, we find that 16 per cent of the customers of the town of 10,000 population used 20 kilowatt-hours or less per month, or 240 kilowatts of energy or less per year. At $17.00 per year, the distribution cost is 7.1 cents or more per kilowatt-hour. The next town studied is one of 3,500 population. The curve shows that 41 per cent of the residence consumers of that town use 240 kilowatt-hours or less per year. In a town of 1,500 population about 45 per cent of the consumers use less than 240 kilowatt-hours per year, and in the town of 500 population, 65 per cent of the consumers use less than 240 kilowatt-hours per year.

Thus, we find that in the average Iowa town of about 1,500 population, we can expect 46 per cent of all consumers to use not more than 20 kilowatt-hours per month, 62 per cent to use not more than 30 per month, and only 7.2 per cent to use over 100 kilowatt-hours per month.

After analyzing these consumer distribution curves, one wonders why the majority of Iowa people do not use more electricity. This question is answered in part by the adverse financial conditions during the past few

years, the types of people that make up our urban districts, the rates charged for service, and the lack of electric appliances in the homes.

In connection with the study of electric consumption, we are making a house to house canvas of all urban homes in several communities. One such survey in a town of about 2,000 population shows forty-four of the residences without electric service. The results of this survey are shown in the following table.

Appliance	No. of Residences having Electric Appliance	% of total residences having electric appliance
Electric lights	455	100
Irons	422	93
Washing Machines	369	81
Radios	334	73.5
Toasters	205	45
Vacuum Cleaners	167	36.7
Fans	59	13
Hot Pads	58	12.8
Waffle Irons	58	12.8
Motors	54	11.9
Refrigerators	46	10.1
Heaters	39	8.6
Percolators	38	8.4
Ranges	21	4.6
Mixers	18	4.0
Water Heaters	8	1.8
Ironing Mangles	2	0.4
Oil Burners	2	0.4

There is a vast field for the sale of electric appliances whenever conditions improve.

Many of the serving groups, municipal and private, are trying to interest their urban customers in electric appliances. Very little merchandising has been done in the smaller communities. Such efforts as have been made in the merchandising field were undertaken, largely, in an effort to counteract the effects of the numerous rate reductions of the past few years. Many groups have conducted special sales campaigns by which they either sold merchandise at little or no profit, or installed it for very nominal rental. The effect of such practices is questionable. Such campaigns work long-time hardships on local merchants, and destroy the effectiveness of dealer organization. It seems that some cooperative plan or system could be worked to the mutual benefit of all concerned.

The multitude of electric rate schedules in use in Iowa today is mute evidence of the haphazard methods by which rates are established. Throughout this mad scramble, one practice has been retained inviolate, i.e., that of "get all you can where you can, and grant favors where necessary."

We do not subscribe to any such practices, but feel, rather, that rates should be based upon legitimate costs. It is true that, in some cases, the private companies have been called upon to meet popular demands for rate reductions. Such a condition can be rectified only by central control and regulation of the entire utility field.

In Iowa, each municipality is a "law unto itself" so far as electric rates are concerned. The town council has the power and authority to establish rates, a fact that is to a great extent responsible for the multitude of rates in effect today. Each town has its opinion, and so presents its case with more or less force; the result is that often one town has a much better rate than another of the same size, served under the same

conditions, and using a like amount of energy.

In the operation of many municipal electric establishments, we find practices concerning distribution and use of electricity which, in a number of cases, do not seem entirely just to all concerned. These municipalities do not account for all electricity distributed, but allow its use without charge for a multitude of purposes and places. Such also is often the practice with the handling of funds and labor of the electric departments. We believe that such an establishment should be operated as a separate enterprise, worthy of its hire, and not subsidized or deprived of revenue by other city departments. Such practices make it impossible to compute service costs as they are classed as "free services". The municipalities contend, and rightly, that such services are rendered in lieu of taxes which would revert to the town if such service were rendered by a private organization.

Our studies indicate that the service charge plus energy type of rate would be most equitable to all electric consumers. This type of rate has been tried by several public service groups but has met with strong public opposition, probably because the public does not appreciate the true cost of service. In many small communities, such rates would increase the electric bills of more than 60 per cent of the consumers, but would reduce the bills of the large users. This is as it should be if true costs are to be distributed on an equitable basis.

Much education will be needed to make the public realize the justification of the service charge. The present agitators for lower rates are asking that the first steps be decreased. These steps do not pay their way now. A decrease throws an even greater burden of supporting the distribution systems onto the heavier users.

We have found that it is not the laboring people who make the loudest

demands for rate reductions; but rather the small shop keepers, the small professional offices, and the retired residents who often leave town on extended visits. Those who most appreciate electric service are the ones who would benefit most by legitimate rate schedules.

Electric service rates in Iowa compare very favorably with those in other sections of the country similarly situated and served. We do find that the low consumption per consumer in Iowa is directly responsible for the high average cost per kilowatt-hour sold, particularly in the small urban communities.

The problem of rate-making can never be finally settled, but will require constant and exhaustive studies as conditions change.

Accounting Practices

In our survey of public service groups, we are attempting a study of the accounting policies and bookkeeping methods used.

The private companies keep rather complete and comprehensive accounts. This may be due, in part, to the necessity of filing reports with the several state offices, the Bureau of Internal Revenue, parent companies, etc.; but it is true that these companies recognize the importance of such accounts in rendering good service. The availability of private utility information for our studies is evidence of the completeness of the records kept by these companies.

The records kept by the municipally owned electric utilities vary greatly in extent and accuracy. In most cases, records are entirely inadequate. However, during the last year, several of the larger municipalities have taken definite steps toward the use of comprehensive systems.

About the only records kept by most of the municipalities are those required by the state Auditor for the annual reports. In some cases, not even that meager information is available except from the memorandum books

or check stubs. The Auditor's office often returns, for checking, etc., from 25 to 40 per cent of the reports. Not more than 75% of the municipalities keep customer ledgers for energy sales; the others have only meter books or receipt stubs. In few cases are sales or purchases summarized. Policies and rates are based upon the amount of money available for paying bills. Very few groups provide depreciation or contingent reserves.

Many municipalities make no attempt to keep funds separate for the individual departments, checks being written on any account that shows a balance. One town drew all checks, for a period of almost a year, against the light account, it being the one best supplied with funds.

The Public Service Division has collected samples of statements and forms used by the municipalities, with a view to making a detailed study of the accounting needs of municipal industries, and designing a simplified system to meet those needs. Most of the forms that were collected provide for some unnecessary data, and omit some data that are essential to effective management and operation.

In most cases, the local councils are responsible for the inadequacy of records. The clerks receive little remuneration for their work, and are not provided with the necessary equipment.

Personnel

There is perhaps no single industry that requires so varied a personnel as does the electric light and power industry. There is the office boy, the clerk, the lineman, the fireman, the plant operator, the engineer, the accountant, the manager, and many others.

This industry deals directly with the people of the community, and must keep unceasing vigil over its public relations. By nature a monopolistic industry, it is forever the object of local criticism.

Most of the private companies can and do employ well-trained men to

direct the varied phases of the industry. But most of the municipal industries are so small that, in few cases are technically trained men in charge. Most of the plants are operated by good mechanics and linemen, but technical matters require the assistance of trained engineers. In some cases, consulting engineers are called in; but in many this precaution is not taken. Some municipalities have allowed equipment salesmen to direct affairs, to the end that their plants are designed, operated and maintained in haphazard fashion.

Few municipalities employ capable accountants; in most cases, financial matters are in the hands of plant superintendents or town clerks. Efficient management and successful operation can be attained only when plants are in charge of men who are capable of handling technical and financial problems, or are willing to consult with experts when necessary.

A check on types of municipal management in towns having electric establishments shows three or four with the city manager form of government; about the same number with the trustee form of utility control; and about 120 with the mayor-council form of management, with superintendents in charge of systems.

In many of the small towns, no one really is in charge of the system. The mayor may handle complaints and hire common labor for repair work. The town marshall or clerk may read the meters, and another man may turn on the street lights. Such methods are not conducive to good service.

In many towns, the members of the council virtually manage the municipal industries. Although they are not familiar with the problems involved, they undertake changes in methods and personnel.

The municipal industries operated under a city manager form of government, a board of utility trustees, or a competent superintendent, are much more successful than are those under other type of management.

We feel that municipal utilities should be regulated to such an extent

the tree trunks. This town does not have a capable superintendent or engineer nor does it have sufficient funds for the construction of a new line to be re-routed around these trees.

Another interesting case is that of a city purchasing 25-cycle energy from a 22 Kv, three-phase transmission line. This line supplies a centrally located substation where the voltage is stepped down to 110/220 volts for distribution throughout the town. For the farm lines supplied from this system, step-up transformers are placed near the corporation limits, on the city distribution system, and the energy is then carried into the rural district at 2300 volts. It was reported in the town that not more than one iron can be used at a time.

The condition of plants and equipment varies from one extreme to the other, according to competence of management and availability of funds. At one extreme are the broken-down plants for which no depreciation allowances were made; at the other are the successful plants whose equipment is maintained in excellent condition. The latter groups deserve complimentary recognition.

Some of the private companies also have equipment whose condition is very poor. In some cases this situation can be charged to over-expansion in more favorable times, but usually it is more chargeable to limited resources.

The poor condition of so much utility equipment is evidence of the fact that, in past years, depreciation was not recognized as a cost of service. Many groups have held that so long as equipment renders service it is as good as new. However, most of these groups finally have been forced to realize that all equipment ultimately must be replaced. Much of the utility equipment in Iowa was built within the past twenty years, which means that many repairs will be needed in the near future. In many plants, more retirements will be caused by obsolescence and inadequacy than by physical deterioration.

As the survey progresses, more will be known of the condition of plants and lines; and it may be possible to estimate the cost of necessary rebuilding

and replacing in the electric light and power industry.

Property Improvements and Extensions

The survey has disclosed the fact that many municipal plants are operating obsolete and inefficient equipment. One plant averaged, during the past three years, between 12.5 and 13.5 pounds of coal, costing between $0.016 and $0.020 per kw-hr. The second plant averaged between 9 and 11 pounds of coal, costing about $0.024 per kw-hr. The third plant averaged, during the past two years, between 8.43 and 8.65 pounds of coal, costing about $0.019 per kw-hr. The United States Bureau of Census reported a 1932 average consumption of coal or its equivalent of 1.47 pounds. These inefficient plants must modernize if they expect to exist in the face of lower electric service rates, and even then, it will be difficult, if not impossible, for small plants to survive.

Present generating facilities are of sufficient capacity to supply Iowa for some years to come, unless the present annual consumption increases to a great extent. Considering the trend of modern electric generation, we can expect very few additional plants in the future. From the standpoint of increased operating efficiency and lower service costs, additional capacity can best be added to large central stations.

A study was made of the service life of various types of equipment, as found in the municipally owned establishments. It is hoped that additional material will be available as the survey continues. From the 104 municipal establishments visited we have found the following average ages of equipment at time of rebuilding or replacement:

Type	Number of Cases	Average age in years at rebuilding or retirement
Distribution System	48	16.2
Transmission Lines	17	16.5
Transmission Substation	6	16.8
Murray Corliss Steam Engines	31	12.7
Ideal Steam Engines	5	16.4
Steam Turbines	7	10.8
Producers Gas Engines	7	7.8
AC Generators	18	11.1
DC Generators	22	17.7
Low Pressure Fire Tube Boilers	47	16.1

Basing our opinion on an average life of 16 years on distribution systems and transmission lines of municipal ownership, we believe that many private lines built during and just following the war will be rebuilt in the next four or five years. Many of the private utility companies have done considerable repair work on their lines during the past few years with the idea of postponing complete reconstruction until conditions become more favorable. At best, these old poles cannot last more than four or five years. Many of the 2300-volt lines which serve suburban and rural consumers are in very poor condition and should be rebuilt.

Transmission facilities, in general, seem adequate at the present time; although as rebuilding becomes necessary, definite improvements as to construction, type, voltage and location can be expected. Large interconnecting systems are becoming more popular and practicable as large central station efficiency increases and the technique of long distance transmission becomes better known. Storms and unfavorable weather conditions, even today, are menaces to electric transmission; but scientific study and research are doing much to decrease failures and service interruptions. New developments in transmission of electricity are extending the distance over which it is economical to transmit.

COMMENTS AND RECOMMENDATIONS

A Public Service Commission

The Public Service Division has uncovered a number of problems concerning the serving of electric energy to the Iowa Public. The most important of the problems is the need for legislation creating a Public Utilities Commission, and in recognition of this fact we have devoted a section of our report to this problem alone. In connection with this legislation, some provision must be made for the appointment and examination of the individuals constituting such commission; a competent board of civil service examiners.

In general, this commission should coordinate and supervise the utility industries and establish suitable rates for all public utility services in the state.

Civil Service for Town Clerks

Town clerks should be appointed on the basis of qualifications, such qualifications being determined by examinations given by a board of civil service examiners. The town clerk should be a full-time public servant, with such duties as taking care of gas refunds and taxes, sales taxes, and records and accounts; and assisting the public with required government reports. The salary of such town clerks should be paid jointly by the municipality and the state.

Accounting Practices

A number of municipalities operating generating plants, for their own convenience and needs, have devised forms for records and reports. Where possible, we have collected samples of all forms used; with the idea of making a special study of the needs of such plants and of designing a uniform system to fill those needs. This uniform system of records should be published and made available for distribution.

The forms and accounts used by municipalities are far from uniform. Many municipalities use no accounting system whatsoever. Town clerks frequently state that they have been refused funds for the purchase of record forms. It seems imperative that municipal accounting be made mandatory by legislative enactment, that town clerks be provided with proper accounting forms, and that suitable office equipment be provided for the protection of records.

Other Public Services

Many towns are without water systems and sewage disposal plants. Such services should be made available before further expansion is made in the electric field. We are not in sympathy with further spending of public

or private funds for a service already adequately rendered, while other services are unavailable. We have found a surprising number of towns without sanitation facilities. The latest case to come to our attention is that of a town of near 1,500 population with virtually no municipal improvements. The one bath tub in the town is served from the railroad water tank. Three stores have water from the same source. Shallow wells supply the balance of the town with near unpalatable water.

Rate Supervision

Some public body should have power to supervise and equalize rates. If a Public Utility Commission is created, this body should have jurisdiction over rates. Our survey has shown that towns owning their own distribution systems and buying power wholesale are paying from 1.6 cents to 5.0 cents per kw-hr. Such a discrepancy is unjustifiable and could be prevented by a regulatory commission.

Wholesale Rates vs Generating Costs

There is no question but that small plants, economically, are unjustifiable. The cost of operating the small plant amounts to more per kw-hr. than the wholesale rate of energy from a high line. It is good business to purchase energy when it can be obtained for less than it can be generated locally.

Combining Government Reports

All the reports required by the various governing agencies should be incorporated into one detailed report. This report should be issued by the Public Service Commission, which would have power to collect whatever data it may desire. All other governing bodies should obtain such data as they require from the Public Service Commission reports.

Planning Transmission Lines

A more effective network of transmission lines should be planned in a

joint conference of private service companies and the proposed Public Service Commission. As the present lines are retired from service, new lines should be constructed to meet the proposed plans. Coordination between companies, and agreements on exchange of energy, where necessary to render good service, should result in a material savings for all concerned.

Municipal Organization

A municipal utility organization should be promoted for the purpose of cooperative purchasing, collection and dissemination of operating information and data, and retaining the services of technical advisors.

Rate Structures

This problem is too complex and involved for the Public Service Division to offer an immediate solution. We feel that present rate structures, due largely to the demands of the public, are inequitable and do not charge for service in relation to its cost. In general the small users are not paying their proportionate share of the costs of service; the result is that the large users must bear the burden. The service charge plus energy, although it has not met with public approval, is recognized by most rate experts to be the most fair in its application. The Public Service Division concurs in this opinion.

We believe that, in the past, too little education and explanation has been carried on concerning service-cost rates and their application. The public relations of both municipal and private systems are important in bringing about favorable understanding and good will.

Property Improvements and Extensions

The present trend in building is toward central systems. Energy can be generated in large quantities and transmitted to the point of distribution more cheaply than it can be generated in a small local unit. Iowa now has generating capacity to supply all needs for the near future. There is little

doubt but that, in the next few years, many small plants will be retired, and more service rendered by privately and publicly owned central stations.

Physical Condition of Plants and Equipment

Not until all the data from our survey is obtained and compiled can we make definite estimates of the amount of rebuilding necessary each year.

The private companies are more disposed to modernize equipment than are the municipalities. Obsolescence and inadequacy cause more replacements than does ordinary depreciation. A number of municipal plants continue to operate their old steam engines although operating costs should preclude their use.

Much physical property has now reached retirement age, but is being kept in repair until conditions warrant rebuilding.

Load-Building

Methods should be devised whereby the public can be made to realize the importance of the load-factor in rate determination. We can but call attention to a well known but little appreciated fact; that a very large part of the cost of rendering electric service is in fixed charges which do not vary with consumption.

In order to improve the load factor and bring about a greater consumption of electricity per consumer, with the resultant decrease in cost per kilowatt-hour, we believe some cooperative plan should be worked out between the merchandise manufacturer, public service groups, and local merchants.

Financing

There is an evident need in Iowa for some practicable method whereby public service groups can reorganize and refinance at a low rate of interest. Such a procedure would reduce the fixed charges incurred in the rendering of such service and would allow material rate reduction.

RURAL ELECTRIC SERVICE IN IOWA

INTRODUCTION

The rural electrification survey was originally introduced under the Civil Works Administration in conjunction with the farm housing survey. The survey was completed in Benton and Story Counties before the project was discontinued on April 1, 1934. Two weeks later the survey was again started as a project under the Public Service Division of the Iowa State Planning Board. The work at this time was divided into two distinct divisions, a field survey and a research study of rural electric conditions.

From the time this project was placed under the supervision of the State Planning Board (May 14, 1934) to January 11, 1935, the assigned personnel varied from two engineers and one clerk to six engineers and one clerk. During this time 15 additional counties were completed by the engineers on the field survey. After the survey of the first ten counties was completed the funds allotted to this project were materially reduced. The curtailment of the funds forced us to discontinue all field work for approximately two and one-half months last fall during the most favorable weather for such a survey.

The surveyors on the forest and wasteland project (#1033) carried our field mapping work in addition to their work in two counties, thereby eliminating much duplication in travel. However, our engineers had to collect other data and prepare the reports necessary to complete the survey of these counties.

On January 11, 1935, the personnel assigned to this project was

increased to 14 engineers and 1 clerk in view of a demand for completing the survey of the state at the earliest possible moment so that Iowa would be prepared to cooperate to the fullest extent with any federal program of rural electrification. It was felt that information of the nature which we were obtaining in this survey was essential before any program of expansion, such as proposed by the federal government, could be wisely conducted.

Under this expanded program we continued to ask the cooperation of the forest and wasteland surveyors in the portion of the state (26½ counties) which neither project had covered, and we confined our engineers' survey to the 56½ counties previously covered by the surveyors on project #1033 but not covered by this survey.

When the rural electrification project was enlarged, four engineers were transferred to this project from the urban survey of the Public Service Division. Therefore, our field engineers were asked to collect urban data on electric, gas, water, sanitary sewage, central heat, intraurban transportation, telegraph, and telephone services in addition to the rural electric survey.

The rural electrification research study, to analyze and arrange the data secured from the rural electrification survey and the material available from other sources, was begun in May 1934 and carried on in cooperation with the field survey work. One of the engineers was assigned to this work during the latter half of May, two during June and July, and one since that time.

HISTORY AND DEVELOPMENT

The production and distribution of electrical energy is comparatively recent, the first city distribution system having been started by Thomas A. Edison in New York City in 1882 with a few score of customers and a capacity of 1200 h.p. Just 50 years later there were 23,858,411 customers with a total consumption of 65,895,975,000 kilowatt-hours, an average of 2,451 kilowatt-hours each.

Most of the development in carrying central station electric power to Iowa farms has taken place since about 1915, when short lines were being run out to pick up some of the more prosperous farms. About the same time, individual home electric plants began to appear to a limited extent. While a few far-sighted utility men have helped in this development, much of the pioneering credit is due to the farmers themselves. In Story County, for example, probably a majority of the rural electric lines were originally built and operated by farmer groups, some of them having operated satisfactorily for 15 to 20 years under farmer management.

The organization of the Committee on the Relation of Electricity to Agriculture in 1923 and of the Iowa Rural Electrification Project at Garner about the same time had a great influence on rural electric development in Iowa. The use of high line power increased rapidly until checked by the severe farm and business depression about 1930, some utilities reporting an actual falling off in connected farms during 1933. However, most Iowa farmers are awake to the convenience and efficiency of electric power, and its use will again increase when farm financial conditions permit.

A comparison of the general coverage by counties as reported in the 1930 Census can be obtained from a study of the accompanying charts. One shows the number of farms in each county and the percentage of these reporting the following farm conveniences; telephone, radio, water supply and electricity. Of the 214,928 farms in the state 84 per cent reported telephone, 52.4 per cent radio, 24.0 per cent water supply, and 21.4 per cent electricity. Although electricity ranks the lowest of these four conveniences we find that it is actually ahead of water supply in 39 of the counties. Appanoose County reports the lowest percentage of electrified farms at 7.5 per cent while Taylor is next lowest with 7.6 per cent. Polk County reports the highest percentage of 40.8 per cent and Scott next with 40.2 per cent.

The other shows for each county the total number of electrified farms, the average number of dollars per connected farm for electric energy, the per cent of electrified farms using high line, the per cent of electrified farms with home electric plants, and the per cent of electrified farms using electric motors.

Iowa has 214,928 farms, of which 46,042, or 21.4 per cent of the total number, are lighted by electricity. No data are given as to whether the energy comes from high lines or from home electric plants, but this can be arrived at from the data showing the amounts paid by farmers to utilities and the number of farms so paying. This number is given for 1930 as 25,149 farms, or 11.7 per cent of the total number of farms. It seems safe to assume that these 25,149 farms paying utilities for energy constitute the total number using central station power. Taking 25,149 from 46,042 leaves 20,893, or 9.7 per cent of the total farms, as those served by home electric plants.

IOWA STATE PLAN — FARM HOME UTILITIES DATA

LEGEND

- PERCENT OF FARMS HAVING TELEPHONES
- PERCENT OF FARMS HAVING RADIOS
- PERCENT OF FARMS HAVING PIPED WATER
- PERCENT OF FARMS HAVING ELECTRIC LIGHTS

LARGE NUMBERS INDICATE NUMBER OF FARMS IN COUNTY

IOWA STATE PLANNING BOARD

THE COMMITTEE ON PUBLIC SERVICE
PROJECT
1052

IOWA STATE PLAN FARM ELECTRIC SERVICE DATA

DATA BASED ON INFORMATION FROM THE 1930 CENSUS

LEGEND

- AVERAGE NUMBER OF DOLLARS PER FARM PAID TO POWER COMPANIES
- PERCENT OF ELECTRIFIED FARMS RECEIVING ENERGY FROM UTILITIES
- PERCENT OF ELECTRIFIED FARMS HAVING HOME ELECTRIC PLANTS
- PERCENT OF ELECTRIFIED FARMS USING ELECTRIFIED MOTORS

LARGE NUMBERS INDICATE NUMBER OF ELECTRIFIED FARMS IN COUNTY

IOWA STATE PLANNING BOARD

THE COMMITTEE ON PUBLIC SERVICE
PROJECT
1052

Hence the 1930 Census shows the following:

214,928 total number of farms

46,042 farms electrified, or 21.4 per cent total farms

25,149 farms served by high line, 54.6 per cent of electrified farms or 11.7 per cent total number of farms.

$1,626,563 paid by farmer to utilities, or $64.64 per farm served.

20,893 farms with home electric plants, 45.4 per cent of electrified farms, or 9.7 per cent of total farms.

17,277 farms with electric motors, 37.5 per cent of electrified farms or 8 per cent total number of farms.

It is interesting to note that Decatur County has a maximum of 87.7 per cent of electrified farms using high line power, while the adjacent Lucas County has the maximum of 73.1 per cent of electrified farms using home electric plants. The adjoining Wayne County shows the minimum of $31.00 per year per connected farm paid for electric power while Monona County shows a maximum of $100.50 per connected farm. Appanoose County, adjacent to Wayne, shows the minimum of 11.2 per cent of electrified farms using electric motors, while Bremer County with 65 per cent has the highest.

The following data on the number of Iowa farms using central station electric power, taken from the ninth annual report of the Committee on the Relation of Electricity to Agriculture checks quite closely with the foregoing estimates:

Year Dec. 1931	No. of connected farms	% increase
1923	11,237	
1924	11,700	4.1
1925	12,400	6.0
1926	13,600	9.7
1927	17,000	25.0
1928	21,825	28.4
1929	25,149	15.2
1930	29,634	17.8
1931	31,688	6.9
1932	31,655	- 0.1
1933		
1934	31,634	- 0.1

PRESENT SERVICE STUDIES

Field Work

Objectives and Purposes

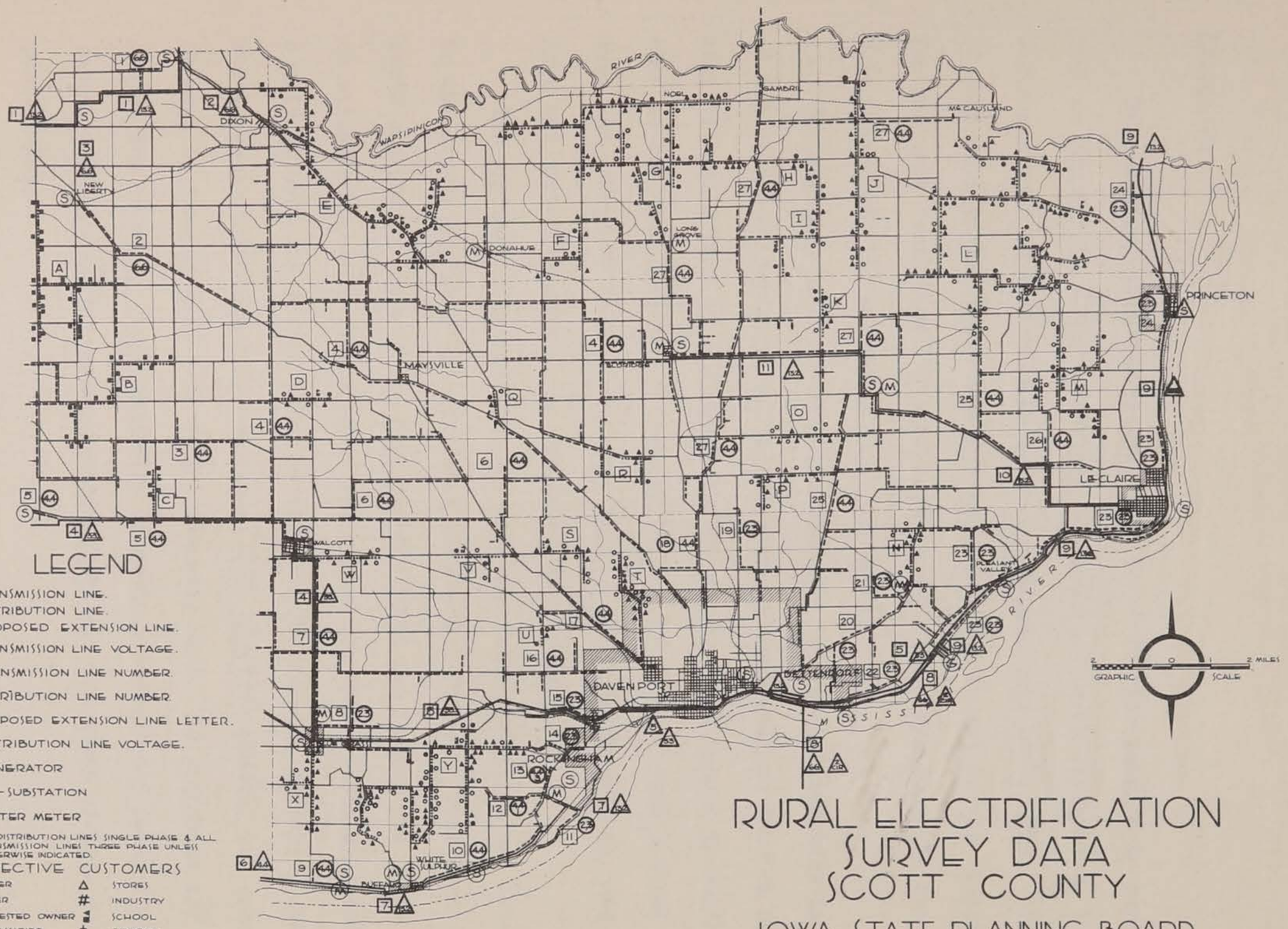
The two principal objectives of this field survey are to study the present situation of the rural electric service and to appraise the feasibility of extending the service to other rural consumers.

In studying the present situation we are determining the location of all transmission and distribution lines, locating connected rural consumers, collecting pertinent data on the existing lines and substations, and collecting data on the kilowatt-hour consumption of the present rural consumers. Further discussion of these data will be found under the "Present Status".

To aid the study of feasible rural line extensions we are showing the present location of all farms, special prospects, and prospective villages and towns on township maps, noting the condition of farmsteads, locating all owner-operated farms, locating home electric plants, and noting conditions of the terrain which may effect power line extensions.

It is believed that this information will bring material benefit to the state of Iowa in the event of any program of rural electrification, and that the maps showing the corrected road, farmstead, etc. locations will be of value to many governmental and private organizations.

The following figure illustrates the work that is being done in the field. We wish to make it clear that "Proposed Extension Line" is not an actual proposal but is an extension that would be possible according to the judgment of the engineer making the survey; his judgment being based upon farm ownership, general condition of the farmsteads, and upon farm density.



LEGEND

- TRANSMISSION LINE.
- DISTRIBUTION LINE.
- PROPOSED EXTENSION LINE.
- TRANSMISSION LINE VOLTAGE.
- TRANSMISSION LINE NUMBER.
- DISTRIBUTION LINE NUMBER.
- PROPOSED EXTENSION LINE LETTER.
- DISTRIBUTION LINE VOLTAGE.
- (G) GENERATOR
- (S) SUB-SUBSTATION
- (M) MASTER METER

NOTE: ALL DISTRIBUTION LINES SINGLE PHASE & ALL TRANSMISSION LINES THREE PHASE UNLESS OTHERWISE INDICATED.

PROSPECTIVE CUSTOMERS

- ▲ RENTER
- ○ OWNER
- ● INTERESTED OWNER
- ■ UNCLASSIFIED
- × SERVICE STATIONS
- △ STORES
- # INDUSTRY
- SCHOOL
- CHURCH

RURAL ELECTRIFICATION SURVEY DATA SCOTT COUNTY

IOWA STATE PLANNING BOARD

THE COMMITTEE ON PUBLIC SERVICE
PROJECT 1052

1052-1

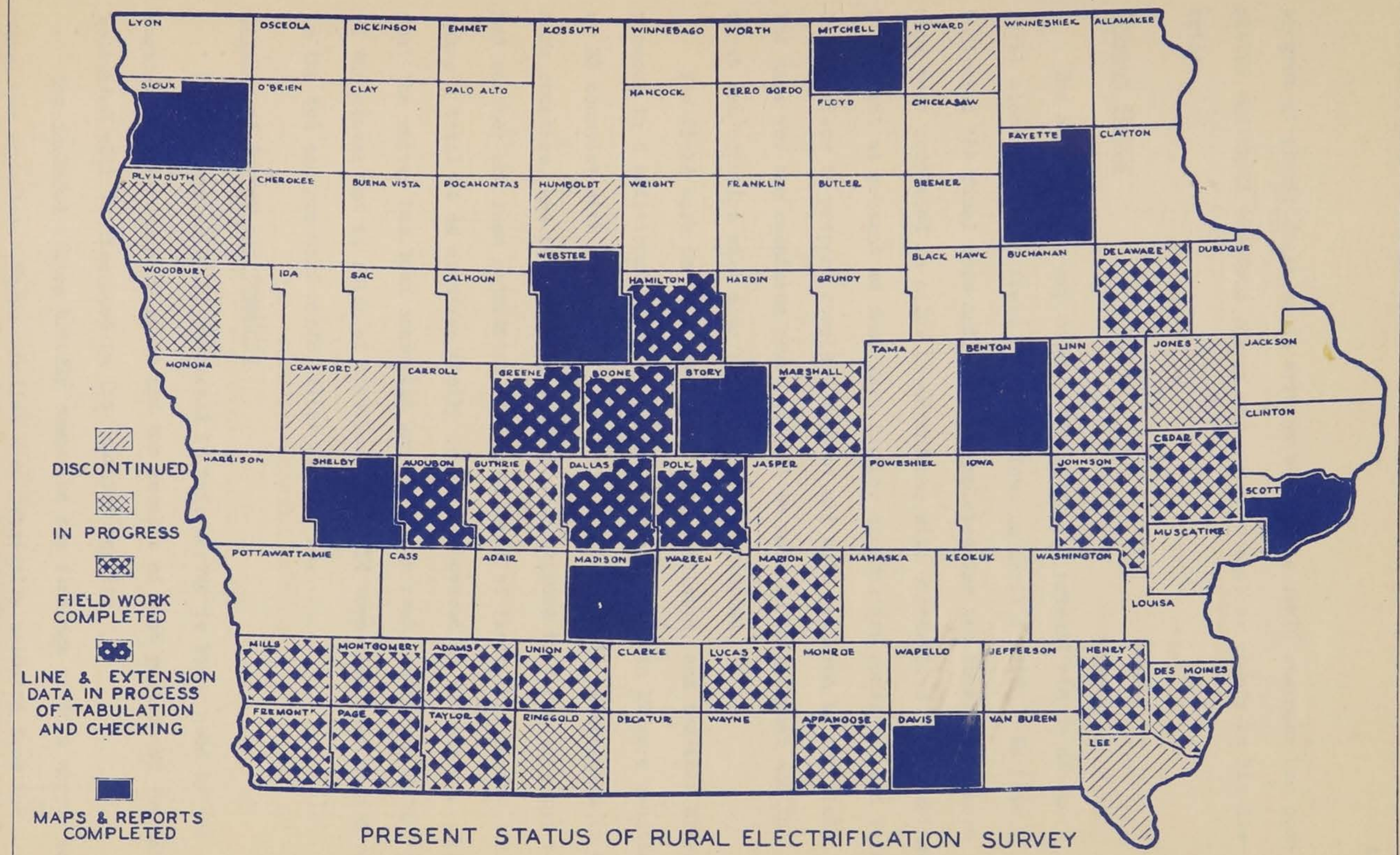
Procedure

Before discussing the present procedure, it will be well to explain that on January 11, 1935 we divided the counties to be surveyed by the engineers into 13 districts of four or more counties each. There are only 12 engineers in the field but work has been done in all of the districts. Two men were transferred to Appanoose County, which was in a district not being surveyed, for a special study in that county.

The engineer upon entering his district sets up headquarters in one of the counties, contacts the relief engineer and arranges for the employment of relief help to assist him in the survey. The manner in which he is able to use this help and the amount he can use depends upon several factors; type and amount of labor available, weather and road conditions, and the type and amount of data to be collected in that county.

The engineer then contacts the utilities municipalities and farm groups in the county securing all available information on power line location, collects one year's consumption data for all rural consumers, and fills in a questionaire on power lines and substations. He then drives all roads in the county or uses the relief labor so that all farmsteads, churches, schools, rural places connected to power lines, home electric plants, and roads are checked or located correctly on the township maps. As townships are completed the corn-hog committeemen or township assessors are interviewed to secure the location of owner-operated farms and the names of home electric plant owners.

The locations of the power lines are transferred to a county map and a report covering conditions which it is believed will tend to influence any



PRESENT STATUS OF RURAL ELECTRIFICATION SURVEY

DATE APRIL 4, 1935

program of electrification is written before the field engineer has completed the rural electric survey and moves to another county in his district.

Present Status

The accompanying map roughly indicates the present status of the rural electrification field survey in Iowa on April 4, 1935. We have indicated the final maps and reports completed for ten counties. These maps were completed in color in accordance with suggestions from Washington, D. C., but at present we feel that further changes are necessary and we are now taking steps to prepare complete maps of all data gathered in the field. The maps for the remaining counties will be made in this manner and the first ten counties will also be redrawn to correspond.

The field work is completed, line data tabulated, and feasible extensions planned in 6 additional counties; field work completed in 17 more counties, or 33 counties with field work completed. Field work is in progress in 4 more counties, and has been temporarily discontinued in 7 counties due to bad weather and road conditions and curtailment of funds this month. This makes a total of 44 counties wholly or partly covered by the survey. This year the survey has been conducted under adverse road conditions in all parts of the state; but in spite of this handicap, 314 townships have been covered in the two and one-half months since January 14.

Results of Survey and Comments

Some of the material collected in this survey is being used by the engineer on the research study and the results of that portion of the data collected will be discussed in the research report.

The included tables briefly summarize the findings of this survey in the first ten counties. These counties were originally selected from the

SUMMARY OF RURAL ELECTRIFICATION SURVEY DATA (10 COUNTIES)

Counties	PRESENT LINES: Distribution Lines	Transmission Lines (under 10,000 volts)	Transmission Lines (over 10,000 volts)	Total Miles of Power Line	Customers per Mile of Distribution Line	Customers per Mile of Transmission Line (under 10,000 volts)	PRESENT CUSTOMERS: Farm Customers	Other Rural Customers	Total Rural Customers	Estimated Average Yearly Consumption (General Farms)	FARMS: Total for County (1930 Census)	PROPOSED EXTENSIONS: Miles of Proposed Extension	Prospective Farm Customers	Other Prospective Rural Customers	Total Prospective Rural Customers	Prospects per Mile
	Miles	Miles	Miles	Miles	No.	No.	No.	No.	No.	KWH	No.	Miles	No.	No.	No.	No.
Benton	119.5	38.6	77.5	235.6	1.8	1.1	246	14	260	635	2595	74.3	223	3	226	3.05
Davis	13.8	30.7	5.2	49.7	2.9	0.7	58	3	61	220	1952	185.0	757	68	825	4.4
Fayette	115.2	17.2	135.0	267.4	3.1	0.6	346	30	376		3038	88.2	335	5	340	3.75
Madison	28.0	17.8	9.5	55.3	3.6	0.7	109	9	118	336	2152	282.2	1147	65	1212	4.3
Mitchell	12.6	18.4	90.5	121.5	2.3	1.4	62	4	66	425	1717	143.3	497	10	507	3.54
Scott	248.6	7.3	74.3	330.2	3.2	0.4	760	42	802	570	2263	119.7	553	26	579	4.83
Shelby	36.8	86.7	0.0	123.5	1.8	0.8	139	4	143	335	2188	44.5	176	6	182	4.1
Sioux	65.7	41.2	129.3	236.2	1.9	0.7	179	12	191	234	2940	69.3	227	27	254	3.7
Story	248.1	18.9	108.2	375.2	2.2	2.4	553	47	600	540	2348	68.0	284	7	291	4.33
Webster	302.1	10.5	143.5	456.1	1.6	0.9	515	29	544	361	2637	51.2	208	12	220	4.3
Total	1190.4	287.3	773.0	2250.7			2967	194	3161		23830	1125.7	4407	229	4636	
Average	119.0	28.7	77.3	225.1	2.3	0.9	296.7	19.4	316.1	472	2383.0	112.6	440.7	22.9	463.6	4.1

CUSTOMERS AND POTENTIAL RURAL CONSUMERS ON POWER LINES

IN TEN IOWA COUNTIES

Counties		Lines under 10,000 volts		Lines over 10,000 volts		Total		Grand Total
		Farm	Other	Farm	Other	Farm	Other	
Benton	* Customers	246	14			246	14	525
	' Adjacent	201	11	51	2	252	13	
Davis	Customers	58	3			58	3	182
	Adjacent	106	7	8		114	7	
Fayette	Customers	336	30	10		346	30	809
	Adjacent	178	24	215	16	393	40	
Madison	Customers	106	8	3	1	109	9	200
	Adjacent	78	1	3		81	1	
Mitchell	Customers	60	2	2	2	62	4	307
	Adjacent	55	2	173	11	228	13	
Scott	Customers	760	42			760	42	1415
	Adjacent	510	46	56	1	566	47	
Shelby	Customers	139	4			139	4	370
	Adjacent	205	22			205	22	
Sioux	Customers	173	12	6		179	12	520
	Adjacent	160	9	146	14	306	23	
Story	Customers	553	47			553	47	1030
	Adjacent	311	19	96	4	407	23	
Webster	Customers	515	20		9	515	29	1102
	Adjacent	434	39	84	1	518	40	
Total	Customers	2946	182	21	12	2967	194	6460
	Adjacent	2238	180	832	49	3070	229	

* Estimated by driving power lines, therefore, includes disconnected farms.

' Adjacent but not connected.

various sections of the state for the farm housing survey last winter and proved to be very representative of the state as a whole. Since considerable information obtained in that survey could be utilized by the rural electrification project, it was thought logical that these should be the first surveyed. Therefore, the data presented in these tables is considered fairly representative of conditions to be found in the state.

From the first we find that in these ten counties there are 1,190.4 miles of farm distribution line, 287.3 miles of transmission line below 10,600 volts which are readily available for farm connections, and 773 miles of transmission line over 10,000 volts making a grand total of 2,250.7 miles of power line with 2,967 farm customers and 194 special rural customers. The average density of consumers along the farm distribution lines is 2.3 per mile. The average yearly consumption for farm customers is 472 kilowatt-hours or less than 40 kilowatt-hours per month.

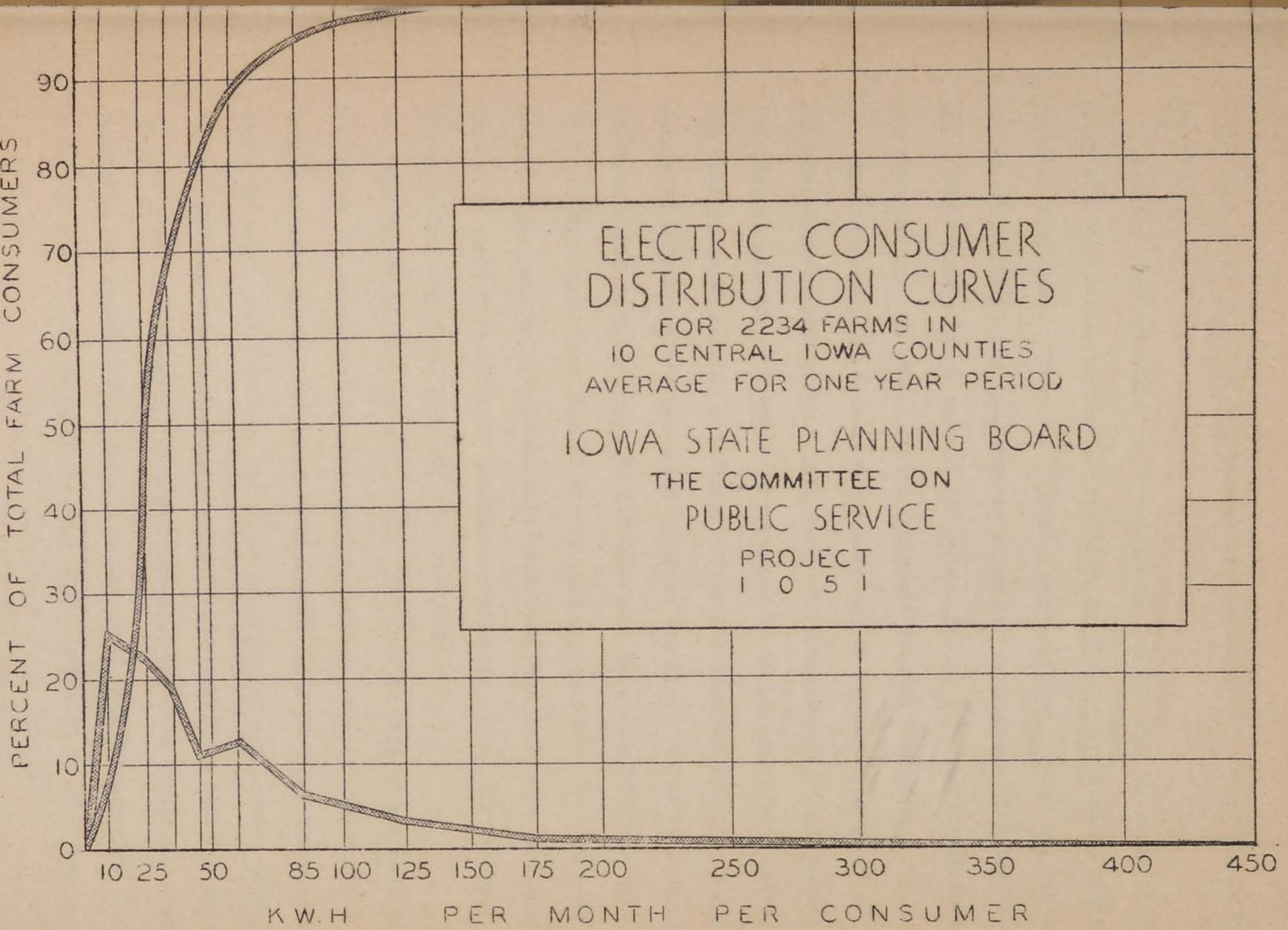
The engineers proposed a total of 1,126 miles of feasible power line extensions in the ten counties which would make this service available to an additional 4,407 farms and 229 other rural prospects or an average of 4.12 prospective rural consumers per mile of extension. These were proposed as being feasible extensions after considering the following factors; desire for service, ownership of farms, density of farms, special prospects, and conditions of the terrain and territory concerned.

The second table, "Customers and Potential Rural Consumers on Power Lines" gives the summary for lines under and over 10,000 volts. From this table we find that there are 6,460 farms, special rural customers, and potential rural consumers along the 2,250.7 miles of line and that slightly less than 49 per cent of these places are actually wired for service. A number of these wired for service are not using energy today, due to one cause or another. Therefore, in addition to the possibilities of power line extensions

ELECTRIC CONSUMER DISTRIBUTION CURVES

FOR 2234 FARMS IN
10 CENTRAL IOWA COUNTIES
AVERAGE FOR ONE YEAR PERIOD

IOWA STATE PLANNING BOARD
THE COMMITTEE ON
PUBLIC SERVICE
PROJECT
1 0 5 1



there is a great need for development of load along the present lines by the absorption of these potential consumers.

Another very important field for developing the load on rural lines which has been merely mentioned heretofore is that of building up the individual farm load. Under the present usage very few farmers can really afford electricity, and they must be shown how to increase this load to a point where they realize some of the advantages of this service in dollars and cents as well as adding to the enjoyment of farm home life.

The importance of this item can more easily be seen by a study of the consumer distribution curve. This curve was prepared from the individual consumption records of 2,234 farm customers in 10 central Iowa counties and the results shown here do not differ materially from the average of approximately 40 kilowatt-hours per month found in the first ten counties surveyed. Of these 2,234 farm consumers 25 per cent used less than 20 kw-hr. per month, 46.7 per cent used less than 30 kw-hrs., 66 per cent used less than 40 kw-hrs., and 76.5 per cent or 1,710 consumers used less than 50 kw-hrs. per month. This very small kilowatt-hour consumption presents one of the greatest problems confronting rural electric service today.

The previous discussion of results obtained in this survey have directly concerned the problem of electrification. Other pertinent information obtained in this survey will be of considerable value to other planning bodies, state or county institutions, and other governmental and private organizations. Here we refer especially to the correction of the township maps as to city limits, farmsteads, schools, churches, and road locations. Under this plan the township maps for the entire state will be corrected within a period of $1\frac{1}{2}$ years, most of the work being completed in less than a year.

Previous available records of this type are badly out of date now and when they are used it is difficult to compare the results of various counties within the state because the mapping survey was spread over a period of several years. On maps prepared in accordance with some of the more recent surveys that had been considered fairly accurate, we found it necessary to make 750 to 1,050 corrections per county because the material was out of date.

Recommendations

We recommend that this project be continuod until the entire state has been covered by this survey because we are obtaining a complete up-to-date record of all transmission and distribution lines in the state and correcting township maps in addition to securing the basic information necessary when considering rural power line extensions. At the present time the state department records of these lines, as well as many of the operating companies' maps, are very inaccurate and out of date.

In summing up the reasons for continuing this survey we find that:

1. It provides a complete record of all transmission and distribution lines.

2. It prepares Iowa to fall into line immediately with any federal program of rural electrification.

3. It provides up-to-date maps on farmstead and road locations.

Research

Introduction

The use of rural electric power is of far-reaching importance to Iowa agriculture and especially to our rural homes, and forms the basis of most plans for making rural homes and farmsteads more attractive, more comfortable, and more efficient. Different women have different concepts of a modern home, but to most farm women the term brings visions of running water with a shining bathroom, and electric power with soft but abundant light wherever wanted, and electrical devices to save time and labor. It is of almost equal importance to the farmer for saving time and energy around the farmstead. Hence it was felt that a careful summary and analysis of the data collected in the rural electric survey and available from various other sources might bring out facts and conclusions of immediate and lasting value in furthering the efficient use of electric power on Iowa farms.

Purposes and Objectives

The purposes of the rural electrification research are briefly:

1. To study the present situation as to the distribution and uses of rural electric power.

2. To study power schedules and rates to get a true picture of the present rate situation and its effect on the use of rural electric power; to work out general rating principles which can be used in determining fair rural rates; and to show the effect of such fair rates on the economy and consumption of rural electric power.

3. To analyze all available data for feasible methods of increasing the profitable use of electric power on farms now connected; to show how new equipment and uses will increase energy consumption and decrease unit costs; and to determine where and under what conditions additional lines can profitably be built.

Present Status

1. A study has been made of the problems of rural electric distribution. Tables and curves have been prepared showing the importance of transformer and line losses and their effect on line efficiency and energy costs, effect of transmission voltage on transformer and line loss, benefits and possibilities of underground construction, design and grades of line construction, line materials, rural line characteristics, etc.

2. Considerable material has been prepared trying to determine the actual cost of electric power delivered at the farm. This will be continued with the help of the cost data secured in the analysis of the operation of the Kegley Branch electric line and with other cost data available.

3. Considerable material has been prepared on rural power utilization. Data have been collected and tables prepared showing the different electric appliances inside and outside the home, with prices, wattage, hours of operation on one kilowatt-hour, and consumer preference for different appliances; also tables showing investment, connected loads and maximum demands, and annual energy consumption for diversified and other types of farms. The following tables show the 1930 census classification by types of the farms in the ten counties first covered by the rural electric survey and the present average farm investment on four of the different types of farm. Surveys of the farm conveniences and electrical equipment have recently been completed on three farm-owned lines near Story City,

4. Kegley Branch Report

Considerable time has been spent in making quite a complete survey and report of the 15 years operation of the Kegley Branch farm-owned and operated

TYPE FARMS IN TEN SURVEYED COUNTIES - 1930 CENSUS

	Benton * 2595	Davis 1952	Fayette 3038	Madison 2152	Mitchell 1717	Scott 2263	Shelby 2188	Sioux 2940	Story 2348	Webster 2637	Total 23830	% of Total
General	575	689	803	266	391	536	276	396	423	365	4,720	19.8
Cash Grain	482	60	49	204	73	124	432	279	777	1,507	3,987	16.7
Crop Specialty	1	4	8	1	17	7			5	7	50	0.2
Fruit	1		1	8	1	14					25	0.1
Truck	27		1		43	107		6	4	16	204	0.9
Dairy	102	70	802	51	237	285	36	76	104	69	1,832	7.7
Animal Specialty	1,212	772	1,052	1,342	784	593	1,324	2,027	745	538	10,339	43.4
Poultry	44	90	56	49	36	70	22	40	75	47	538	2.3
Self-sufficing	58	129	19	69	49	38	19	13	31	40	465	2.0

* Total farms in the county.

PRESENT AVERAGE FARM INVESTMENT IN ELECTRICAL EQUIPMENT

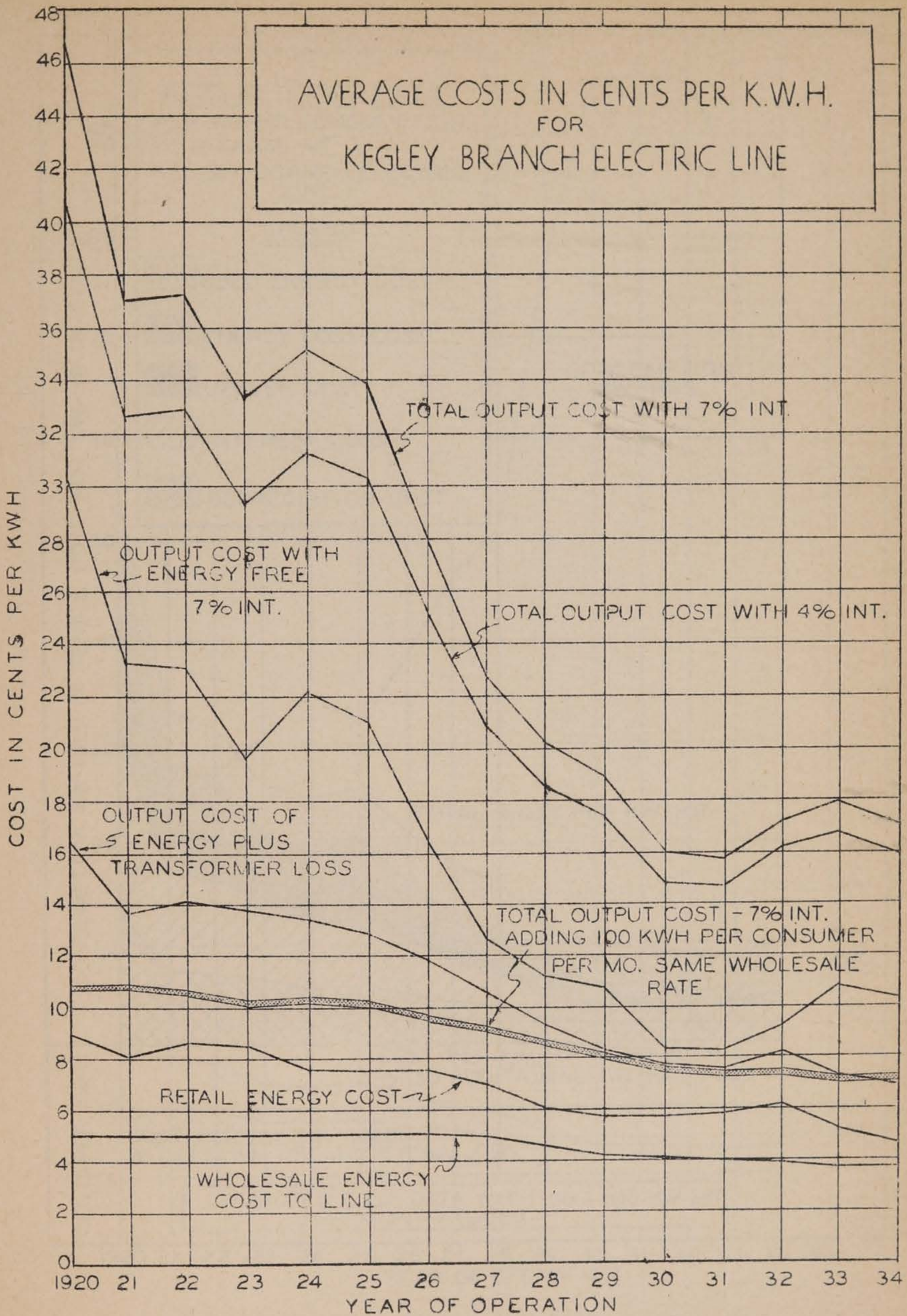
Appliance	Investment			
	Dairy	Livestock	General	Cash Grain
House				
Lights	(20 outlets) 115.60	(18 outlets) 104.00	(16 outlets) 91.20	(16 outlets) 91.20
Washing machine	90.00	90.00	90.00	90.00
Radio	50.00	50.00	50.00	50.00
Water system	85.00	85.00	85.00	85.00
Iron	5.00	5.00	5.00	5.00
Vacuum cleaner	50.00	50.00	50.00	50.00
Hair curler	2.00	2.00	2.00	2.00
Fan	5.00	5.00	5.00	5.00
Toaster	8.00	8.00	8.00	8.00
Farm				
Lights	(19 outlets) 64.70	(18 outlets) 61.40	(18 outlets) 61.40	(9 outlets) 30.70
Brooder	18.00	30.00	18.00	
Milking machine	175.00			
Power for separator	25.00	25.00	25.00	
½ h.p. utility motor	35.00	35.00	35.00	
TOTAL INVESTMENT	728.30	550.40	525.60	416.90

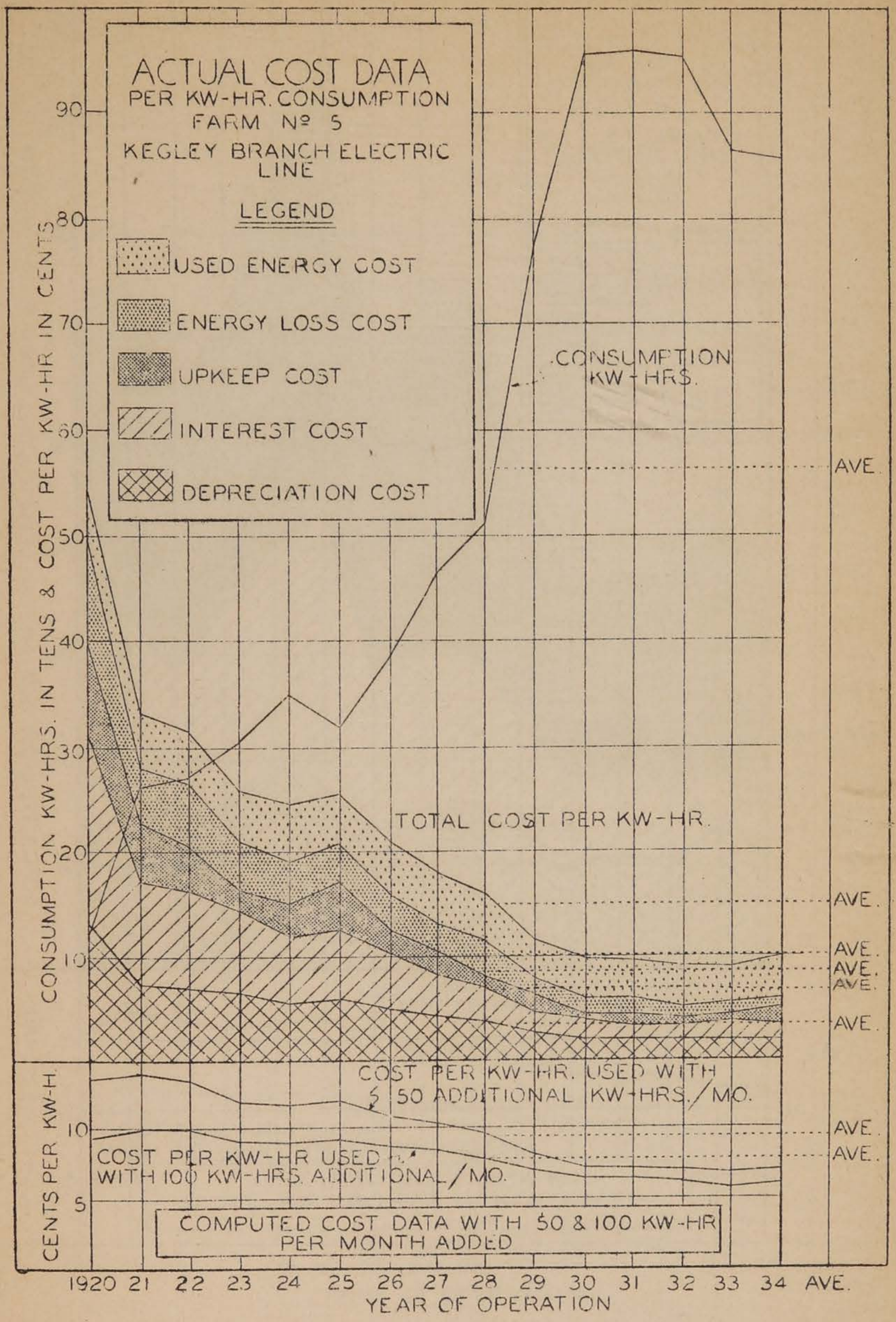
rural electric line. Complete data have been secured of the yearly cost of line upkeep, taxes, wholesale payment for energy, transformer and line losses, line efficiencies, energy consumption and transformer and energy costs for each farm, etc. Depreciation and interest charges have been carefully estimated, and from these the total costs for each year have been computed.

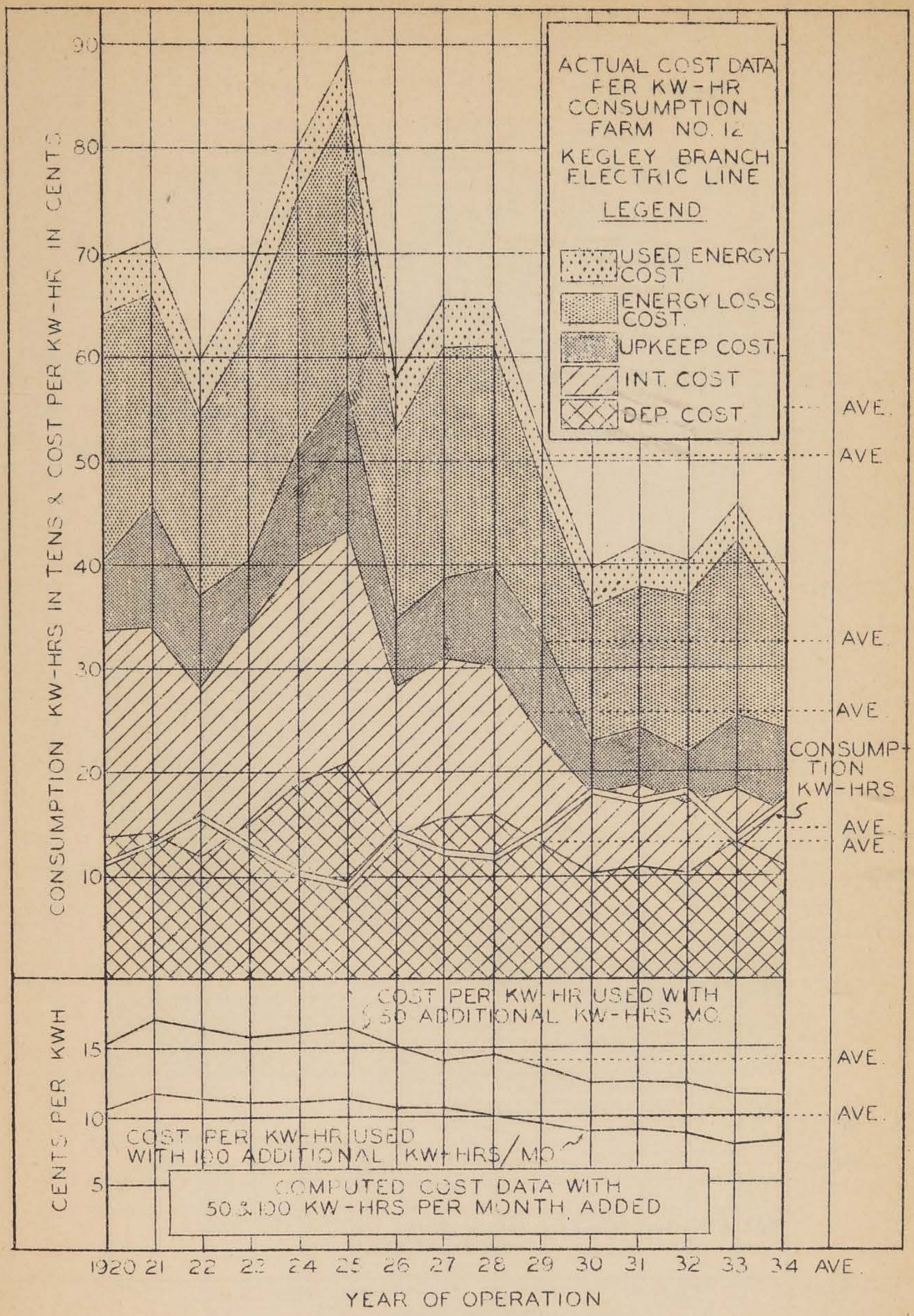
From the total line costs and energy input and output, complete data have been worked up showing the average costs for each consumer per month and per kilowatt-hour used over the full period of operation. The cost of the energy used in some cases was as much as 90 cents per kilowatt-hour, while on other farms using current liberally it was as low as 6 cents per kilowatt-hour. Tables were also prepared and curves drawn showing the effect of adding 50 and 100 kilowatt-hours per month to each farm's energy consumption. The figure illustrating the average costs in cents per kilowatt-hour, for the line as a whole for each year, is of considerable interest. Of especial interest are the top two curves, showing the difference between 7 percent and 4 percent interest on the unit cost of energy; the third curve from the top, showing that the cost per kilowatt-hour would have ranged from a maximum of 30 cents in 1920 to a minimum of 8 cents per kilowatt-hour in 1931, even if Story City had given them the current absolutely free of any cost; and a comparison between the top curve and the third from the bottom, which shows the total cost per kilowatt-hour used, if each consumer were to use an additional 100 kilowatt-hours per month.

Figures are submitted to show the relative yearly costs of service for the heaviest consumer, farm No. 5, for the lightest consumer, farm No. 12, and for an average farm on the line, also the yearly kilowatt-hour consumption of each. The curves for 50 kilowatt-hours and 100 kilowatt-hours per month additional consumption on each farm illustrate the importance of increased use of energy.

AVERAGE COSTS IN CENTS PER K.W.H.
FOR
KEGLEY BRANCH ELECTRIC LINE




ACTUAL COST DATA
PER KW-HR. CONSUMPTION
FARM Nº 5
KEGLEY BRANCH ELECTRIC LINE
LEGEND
USED ENERGY COST
ENERGY LOSS COST
UPKEEP COST
INTEREST COST
DEPRECIATION COST
CONSUMPTION KW-HRS.
AVE.
CONSUMPTION KW-HRS. IN TENS & COST PER KW-HR IN CENTS
90
80
70
60
50
40
30
20
10
TOTAL COST PER KW-HR.
AVE.
AVE.
AVE.
AVE.
AVE.
COST PER KW-HR. USED WITH
50 ADDITIONAL KW-HRS./MO.
AVE.
AVE.
COST PER KW-HR USED WITH 100 KW-HRS. ADDITIONAL/MO.
CENTS PER KW-H
10
5
COMPUTED COST DATA WITH 50 & 100 KW-HR PER MONTH ADDED
1920 21 22 23 24 25 26 27 28 29 30 31 32 33 34 AVE.
YEAR OF OPERATION


ACTUAL COST DATA PER KW-HR CONSUMPTION FARM NO. 12
KEGLEY BRANCH ELECTRIC LINE
LEGEND
USED ENERGY COST
ENERGY LOSS COST.
UPKEEP COST.
INT. COST
DEP. COST
AVE.
AVE
AVE
AVE
AVE
AVE
AVE
AVE
CONSUMPTION KW-HRS
CONSUMPTION KW-HRS IN TENS & COST PER KW-HR IN CENTS
90
80
70
60
50
40
30
20
10
CENTS PER KWH
15
10
5
COST PER KW-HR USED WITH $.50 ADDITIONAL KW-HRS MO.
COST PER KW-HR USED WITH 100 ADDITIONAL KW-HRS/MO
COMPUTED COST DATA WITH 50 & 100 KW-HRS PER MONTH ADDED
1920 21 22 23 24 25 26 27 28 29 30 31 32 33 34
YEAR OF OPERATION

ACTUAL COST DATA
PER KW-HR. CONSUMPTION-AVERAGE FARM ON 1½ KVA TRANS.
KEGLEY BRANCH ELECTRIC LINE

LEGEND

- USED ENERGY COST.
- ENERGY LOSS COST.
- UPKEEP COST.
- INTEREST COST.
- DEPRECIATION COST.

CONSUMPTION KW-HRS. IN TENS & COST PER KW-HR. IN CENTS

90
80
70
60
50
40
30
20
10
0

CONSUMPTION KW-HRS.

TOTAL COST PER KW-HR.

AVE.
AVE.
AVE.
AVE.
AVE.
AVE.

CENTS PER KW-HR.

0
10
5

COST PER KW-HR. USED WITH 50 ADDITIONAL KW-HRS/MO.

AVE.

COST PER KW-HR. USED WITH 100 KW-HRS ADDITIONAL/MO.

AVE.

COMPUTED COST DATA WITH 50 & 100 KW-HRS. PER MONTH ADDED.

1920 21 22 23 24 25 26 27 28 29 30 31 32 33 34 AVE.

YEAR OF OPERATION

SUMMARY KEGLEY BRANCH ELECTRIC LINE

Total length of line	11.5 miles
Total number consumers	33
Three rural schools receive some free energy	
Consumers per mile	2.87
No commercial consumers	
Average total line investment up to and including meters, with no costs for right of way and with most of the common labor donated	$12,256.76
Total line investment per mile	1,065.80
Average total operative cost per year, exclusive of wholesale energy costs	351.55

This is 2.87 percent of the average investment

The operative cost for 1934 was $465.30 or 32.4 percent more than the average.

This is due to the lack of adequate upkeep; higher costs may be expected from now on.

This average operative cost of $351.55 covers an average of only $85.16 per year for taxes and insurance, which is about one-third what a utility firm would have to pay on the same investment.

Average wholesale energy cost per year	$1,116.87
Average depreciation at 5 percent per year	614.24
Average interest charge at 7 percent on the average rate base value (about 69.3 percent of investment)	586.19

Item	Per Mile per Year	Per Customer per Year		
		2.87 per Mile Kegley Branch Line	2.3 per Mile Present Iowa Survey	4 per Mi. Probably Best Possible in Iowa
Average investment	1,065.80	371.36	463.40	266.45
Average upkeep cost	30.57	10.65	13.29	7.64
Average depreciation at 5%	53.41	18.61	23.22	13.35
Average interest at 7%	50.97	17.41	22.16	12.74
Total cost exclusive of energy lost	114.95	46.67	68.67	33.73
Average energy payments	97.12	33.84	42.24	24.28
Average cost per year	212.07	80.51	110.91	58.01
Average cost per month	17.67	6.71	9.24	4.83

distribution efficiency on the three rural electric lines included in the Iowa rural electrification project at Garner were 63.7, 70.1, and 64.1, or an average of 66 percent. However, the Kegley Branch line near Story City showed a minimum distribution efficiency of 29.9 percent and an average over nearly 15 years of 44.9 percent. More than half the energy was wasted in transformer and line losses. Some reduction in energy losses can be secured by using only high grade material and by careful tree trimming; but most loss is due to energizing the transformers. The best way to increase the distributive efficiency is to encourage each consumer to use more power.

Good voltage regulation is very important on rural electric lines, since excessive voltage drop makes lights burn dim, interferes with the proper heating of stoves and electric irons, and causes trouble with motor operation. Reliability of service is also important, since failure of the current for any length of time is very inconvenient and occasionally may cause actual loss. Good regulation and reliability are easily secured, but the increased cost may be more than is justified.

Safety to life and property also are important factors, but present standards are taking care of these factors very well. In 1931, the direct and indirect deaths from electric current in the United States totaled 780, as compared with 2,674 from excessive heat and 29,658 deaths due directly to automobile accidents. Property danger from defective wiring is also important, since the loss in such cases is very often total. Many people are prone to lay any fire of undetermined origin in an electrified building to defective wiring, when often it is due to other causes.

Most rural distribution lines are of single phase, this type being simpler and cheaper to construct and operate than three phase. Large motors, however, require three-phase service. Early lines were nearly all 2300 volts, but if too long or too heavily loaded, these gave trouble from poor regulation;

6600-volt single-phase lines now seem to be rapidly replacing the 2300-volt lines. Several other voltages are in use, however, and there is need of better standardization. Some study has been made of the relative cost and merits of the 4000-volt Y-connected single-phase line with one wire grounded, the new surge-proof transformers, the new metal cross-arms, the newer types of underground cables, the simplified wiring for rented homes, and other devices for improving or cheapening distribution.

Rates and Policies

The cost of electric energy naturally is an important factor in whether electric power is profitable or unprofitable to the farmer, and certainly as to whether or not he is a satisfied customer. The factors which most closely affect the consumers are the power firm's policy on line investment or ownership, service line ownership, transformer ownership, demand and service charges, energy charges, minimum monthly charges, relation between old and new customers, etc. A careful study has been made of the rates and policies of a number of Iowa private utility and municipal rural electric lines. Since the different rates were based on a variety of different conditions and assumptions, it was necessary for direct comparison to bring them all down to the same general bases. Hence, all rates were brought down to the actual total cost per consumer per month with two consumers per mile, each served by a $1\frac{1}{2}$ kv-a transformer and 150 feet of service line included with the cost of the line. Cost consumption curves have been prepared as shown covering the actual monthly cost as adjusted for two consumers per mile and a $1\frac{1}{2}$ kv-a transformer for 20 Iowa rural electric rates and an average curve has been plotted for the given utilities.

IOWA STATE PLANNING BOARD

COST CONSUMPTION CURVES FOR IOWA RURAL ELECTRIC RATES

ADJUSTED FOR 1½ K.V.A. TRANSFORMER, TWO CUSTOMERS PER MILE

PREPARED BY
THE COMMITTEE ON
PUBLIC SERVICE
PROJECT
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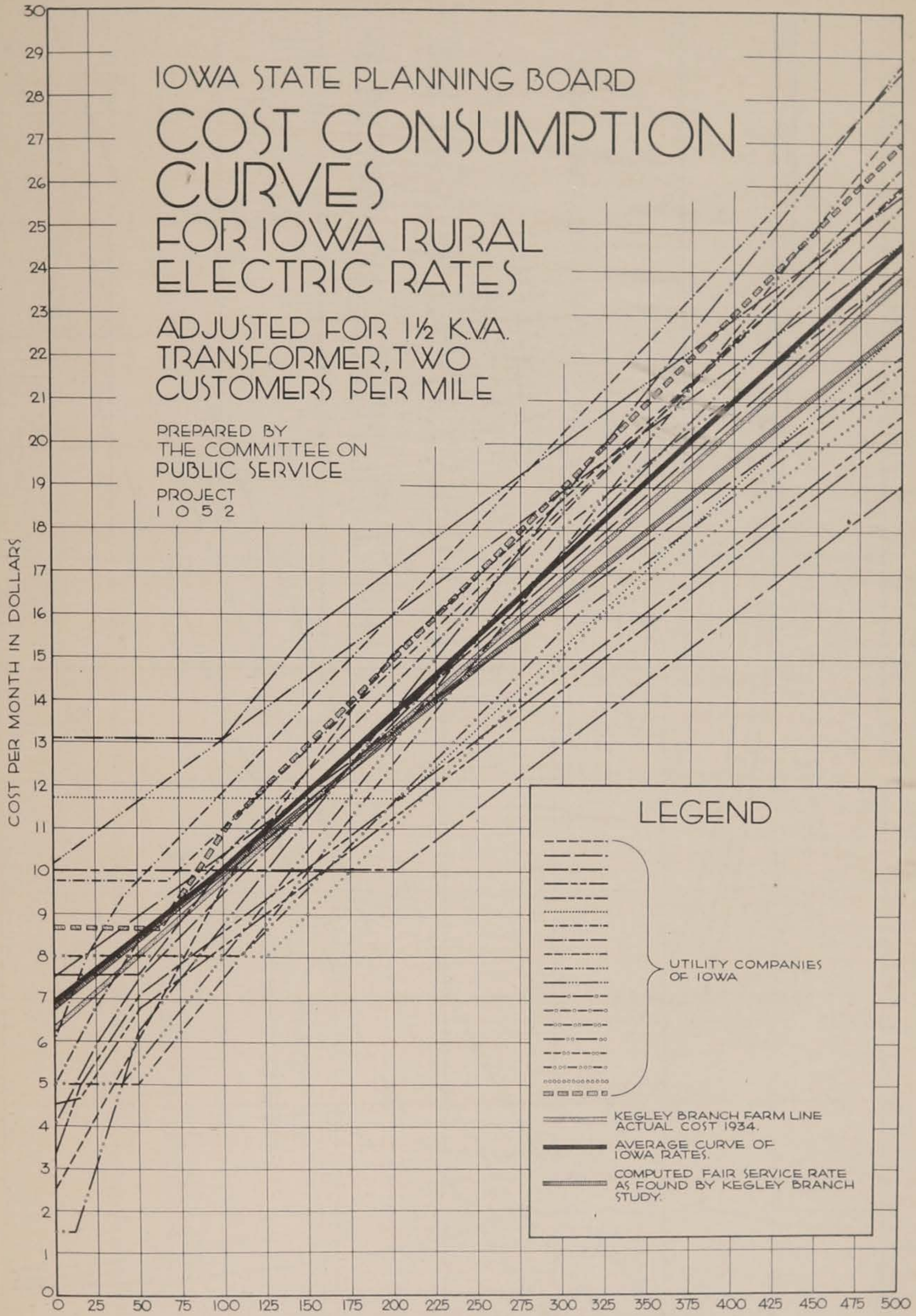


EFFECT OF SIZE OF TRANSFORMER ON MONTHLY CHARGE & COST PER KW-HR.
COMPANY A

ADJUSTED COST PER KW-HR.

ADJUSTED CHARGE PER MONTH

——— 1 TO 3 KVA - 2 CUSTOMERS PER MILE

– – – – 5 KVA - " " " "

— – — 7.5 KVA - " " " "

COST PER MONTH IN DOLLARS

0 2 4 6 8 10 12 14 16

COST PER KILOWATT - HOUR IN CENTS

0 8 16 24 32 40 48 56 64

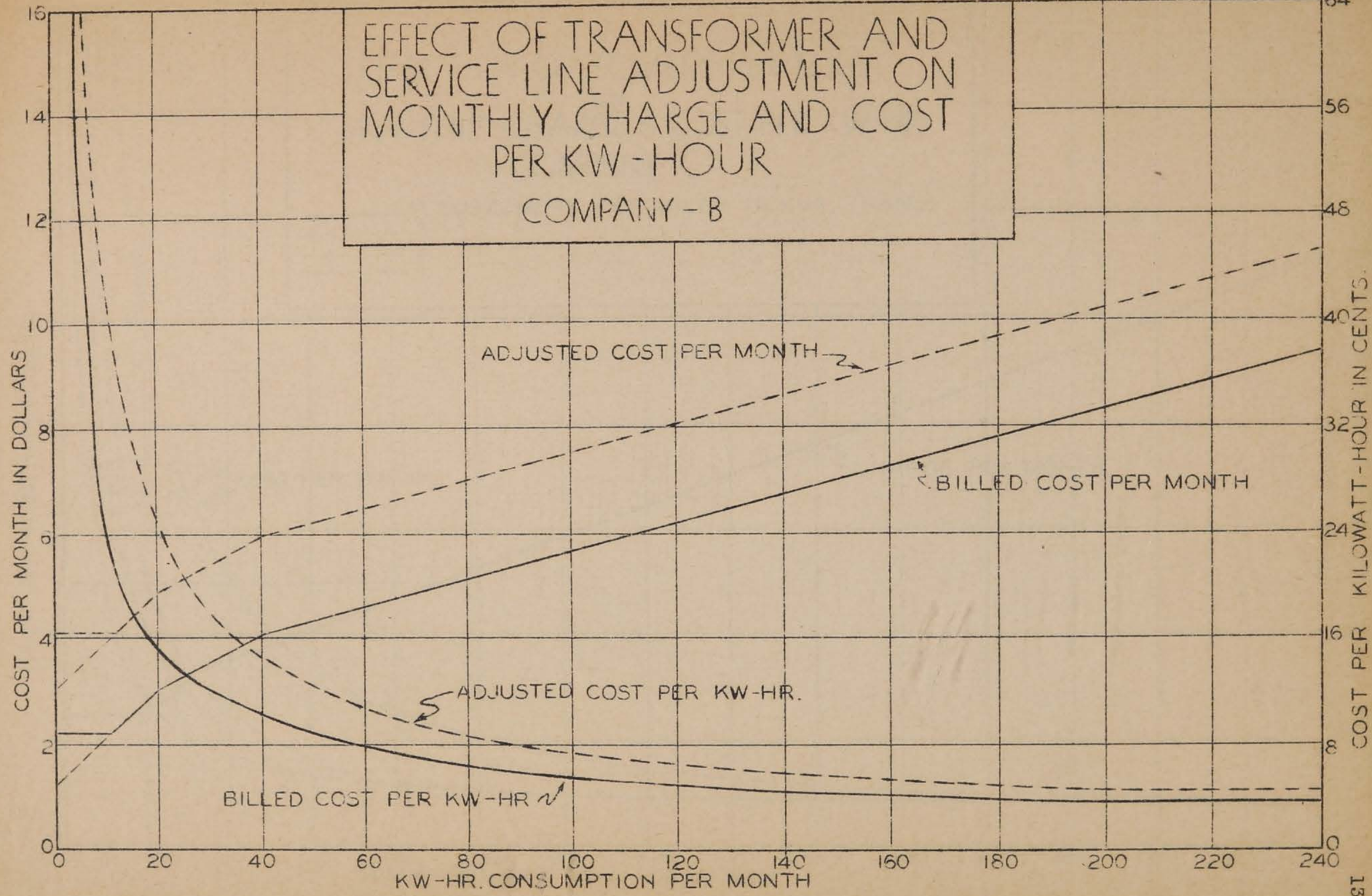
0 20 40 60 80 100 120 140 160 180 200 220 240

K.W.HR. CONSUMPTION PER MONTH

621 I29

EFFECT OF TRANSFORMER AND SERVICE LINE ADJUSTMENT ON MONTHLY CHARGE AND COST PER KW-HOUR

COMPANY - B



130

EFFECT OF CUSTOMERS PER MILE ON MONTHLY CHARGE & COST PER KW-HR COMPANY C

4 CUSTOMERS PER MILE - 1½ KVA TRANS.
3 " " " " " "
2 " " " " " "
1 " " " " " "

COST PER MONTH IN DOLLARS

COST PER KW-HR.

CHARGE PER MONTH

COST PER KILOWATT - HOUR IN CENTS

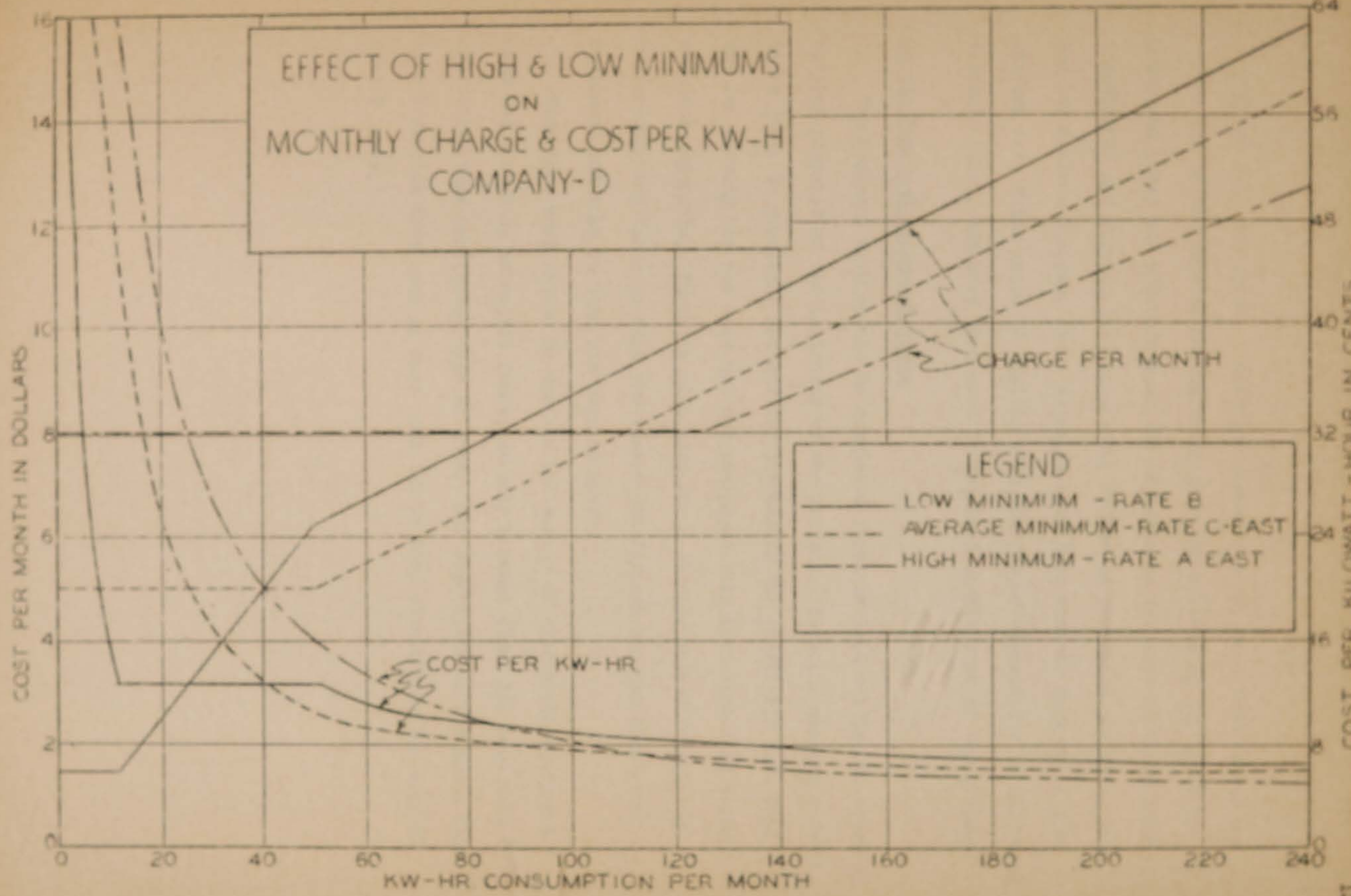
0 4 8 12 16 20 24 28 32

0 10 20 30 40 50 60 70 80

0 40 80 120 160 200 240 280 320 360 400 440 480 520 560 600

KW-HR CONSUMPTION PER MONTH

EFFECT OF HIGH & LOW MINIMUMS ON MONTHLY CHARGE & COST PER KW-H COMPANY-D



Space will not permit a detailed discussion of these rate charts and curves and of the several curves which show the effects on the costs per month and costs per kilowatt-hour for adjustments for size of transformer, transformer and service line ownership, number of customers per mile, high and low minimum charges, etc. Attempts have been made to work out a fair uniform rate which could be applied with the proper adjustments to all rural electric lines, but more work will be required on this part of the project.

Conclusions and Recommendations

The research work should be completed about as laid out in the research outline prepared at the beginning of the project. Especial attention needs to be given to practical methods for increasing the profitable farm load and for showing how new uses and new equipment will make farm life easier and more enjoyable. There is also need for a cheaper method for wiring renter-operated farms so that the renter can furnish his own electrical equipment and take it with him when he moves.

Much more work should be done in the survey of electrical equipment used and needed on connected farms, as only a small start has been made in collecting this particular type of data. Our experience so far along this line indicates that much of this work can be done with the better type of relief labor.

PUBLIC UTILITIES LEGISLATION IN IOWA

As a basis for a study of public utility regulation in the state of Iowa, we have analyzed the Bonbright Utility Regulation Chart as published in Moody's "Public Utilities" for 1934.

Delaware is the only state in the union that has no commission for regulating public utilities. Thirty-six states have commissions that are established for the purpose of regulating corporations and/or public utilities. Montana's Railroad Commission is, ex officio, a Public Service Commission, bringing the total to thirty-seven. The state of Iowa has a Railroad Commission, the only commission in the state with regulatory authority over utilities. However, this commission has no jurisdiction over private companies serving electric light, heat and power; its only jurisdiction in this field is over electric transmission lines, built outside of city corporate limits, and over pipe lines. The commissions of forty-one states have jurisdiction over private companies serving electric light, heat, and power. Only six do not, and Iowa is one of these six; the other five states are Florida, Mississippi, Texas, South Dakota, and Minnesota (Delaware is not considered). The commissions of Florida, Iowa, Minnesota, Mississippi, Nebraska, and South Dakota, have no jurisdiction over privately owned gas companies. The Texas Commission has jurisdiction over natural gas only.

In eighteen states, the commissions have jurisdiction over rates and/or rate schedules of municipalities; in four, control is limited. With private companies, the situation is different; all states except Arkansas, Flordia, Iowa, Minnesota, Mississippi, Nebraska (electric only), South Dakota, and Texas (natural gas only), have powers to regulate rates and/or rate schedules for electric light, heat, power, and gas service.

In all states, except Florida, Iowa, Minnesota, Mississippi, Nebraska, New Mexico, South Carolina, South Dakota, and Texas (Delaware not considered), accounting classifications have been adopted for gas and electric companies.

Of these, twelve states have adopted accounting classifications for electric companies only, leaving twenty-five states that have adopted such for both electric and gas companies (twenty-six if the District of Columbia is included). In twenty-nine of the above states, the classification of accounts prescribed is the Uniform Classification of Accounts adopted by the National Association of Railroad and Utilities Commissioners.

This analysis is sufficient to show that Iowa is far behind most states in the matter of public service control. The present conditions of many of the private and municipal service groups give evidence of the need for a regulatory commission. A study of a map of the territories served by private companies give still more evidence of this same need.

Many plants, both municipal and private, have been overbuilt. Many small towns have tried municipal industry and have failed. Many more have plants which, compared with the large central stations, are appallingly inefficient. A few of these plants have skilled management, and are operated efficiently.

This state could benefit greatly by central planning and regulation of all public service industries; including electricity, gas, ice, cold storage, water, telephone, telegraph, radio, and street railways.

Before offering any recommendation for utility regulation in the state, it is necessary to make an intelligent study of the jurisdiction of all existing governmental agencies which, in any way, regulate or control such utilities.

In this discussion, it should be understood that the Public Service Division makes no inferences whatsoever to any individual who holds or has held public office, either municipal or state. We are suggesting legislation that will strengthen the public services of the state, and overcome some of the present day evils.

Weakness of present regulation -- According to the present statutes, six governing bodies have jurisdiction over the public utilities of Iowa. Of these, the Secretary of State, the State Board of Assessment and Review, and the city and town governments, have the greatest regulatory powers.

City and Town Governments -- The city and town governments have sole power to regulate construction and rates, and Section 6143 of the Code of Iowa, provides that "this power shall not be abridged by ordinance, resolution, or contract". But, despite this provision, the small town that cannot have municipal industries, is at the mercy of the company upon whom it must depend for service. Such situations, in many cases, have resulted in excessive rates.

State Board of Assessment and Review -- The State Board of Assessment and Review has power to obtain valuations for taxing purposes. Basically, the valuation for taxing purposes should be the same as that declared for a rate basis, except that intangible values should be included in the rate basis valuation. The new theory of taxing is based on gross revenues minus general overhead, with no consideration given to the size of the investment. Conservative business practices demand a small figure for intangible values, yet actually there is often a wide variation between rate and tax valuations. The valuation given for the issuance of securities (securities as defined by Iowa law) should be the declared taxable valuation, plus recognized intangibles. By the present law, if book values are inflated, it is possible to increase the issue of securities. When a company's book values are inflated, they should be compelled to declare such valuation the taxable valuation; in other words only one basis of valuation should be allowed for all purposes.

Secretary of State -- By law, the Secretary of State has full power to decide whether or not the sale of a security is <u>fraudulent</u>, and whether a business <u>is or is not based upon sound business principles</u>. Just what 'is or is not' a sound business principle, is left to the judgment of the Secretary of State.

If we consider the problems involved in present-day finance, and the difficulty of determining the soundness of business principles, it seems

absurd to place such a responsibility upon one person. Such a situation, also, is conducive to political favoritism and unfair discrimination. We believe that the sale of public utility securities is so important as to warrant supervision and regulation by a competent, non-partisan group.

Accounting practice and regulation -- No accounting procedure is specified by state law, except that required of pipe line companies by the State Board of Assessment and Review, and of the city and town officials by the State Auditor. Most of the private companies keep comprehensive records, but municipalities, in general, are very lax. Of the latter group, many have only "check book" records, and officials judge operating efficiency by the difference between receipts and disbursements.

We believe that a comprehensive system of accounts, providing for depreciation and for additions and betterments, should be developed and imposed upon municipal industries. Present practice places upon the city or town clerk the responsibility of making collections and disbursements, keeping all city records, and filing reports with numerous county and state offices. In most of the small towns, this work is handled by someone who has other regular, full-time employment. This situation can hardly be rectified so long as the remuneration for such work is so inadequate. Certainly persons who are capable of creditably discharging these duties cannot be secured for the salaries now offered by most towns. In one town, the clerk's pay was the privilege of using the money entrusted to him. The situation is such that, in many cases, the records do not provide even the few divisions of accounts required by the State Auditor.

Although the installation of new accounting systems would entail, for a time, extra work, it will mean ultimate savings to all towns involved. We suggest the employment of a public clerk to keep all city and school records and make the necessary reports, take care of sales and gas tax reports, and help with income tax reports. Such clerks should be selected by civil service

examinations, and would become the states' representatives in their communities. The salaries should be commensurate with the duties involved and with the standards of living in the particular communities. It may be necessary to combine two or more towns under one clerk, in order to provide an adequate salary.

The examinations should be given by a civil service commission, and the three highest applications submitted to the local officials for final selection.

Public Service Commission -- Under the present system, whereby utility companies must make reports to six governmental agencies, there is much unnecessary duplication. There is no one agency with power to regulate service, rates, or accounting methods, or to make valuations of physical property for taxing or rate-making purposes.

In view of this unsatisfactory situation, we recommend and urge the creation of a single commission, with sole jurisdiction over all utility services; to the end that these services are supervised and coordinated to the best interests of the state, the people, and the serving groups.

This commission should provide forms for the collection of all data required by governmental agencies from all persons, copartnerships, cooperatives, corporations, or syndicates, rendering public service.

This commission also shall have power to make any and all other investigations and surveys which it deems necessary in carrying out the powers vested in it; and shall have power to operate public service properties, operating within the state, in time of strike or other social disorders.

In the face of efforts now being made to reduce governmental costs, financing a new commission is a problem. We feel that the costs of compiling reports should be borne by the individual service companies, such cost to be apportioned on an equitable basis. The commission should undertake to furnish competent accountants and engineers to assist those companies who desire assistance in making up reports.

The commission should have jurisdiction over the following utilities:-

Electric light and power,
Heating,
Gas,
Pipe lines,
Transmission and rural lines,
Telephone and telegraph,
Water,
Ice and cold storage,
Street railways,

and all other utilities for which jurisdiction is not otherwise specifically delegated.

If publicly-owned power districts are created, they shall be granted permission to organize and operate only at the discretion of the Public Service Commission, and under its supervision.

Every effort should be made to prevent the proposed commission from becoming a political organization. Only competent engineers, preferably with utility experience, should be considered. At least three men should form the commission, one to be appointed to serve two years, one four years, and one six years, and thereafter, one man should be appointed each two years to serve for a period of six years. Not more than two should be of the same political policy. These commissioners, preferably, would be appointed by the governor of the state one year after he has entered office. No appointee should be installed until he satisfactorily has passed an examination conducted by a competent body, and has been approved by the state senate. No man, serving on the commission, should hold any other active position during his term as commissioner, but should receive a remuneration commensurate with his duties as a state officer, devoting his full time and capabilities to his office.

No specific legislation should be enacted except as recommended by competent, disinterested persons who shall have made a thorough study of the jurisdiction of such commissions in a number of the other states of the nation. With this thought in mind, the Public Service Division of the State Planning Board of Iowa has secured, from several other states, acts pertaining to such

public service commissions as are provided for in those states. The best regulations are in New York, Massachusetts, Wisconsin and California. We feel that if a Public Service Commission were formed in Iowa on an enactment featuring desirable statutes from these four states, Iowa would soon have better service, and at a lesser cost to both those serving and those desiring the service.

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