ELECTRIC POWER AND THE NATIONAL ECONOMY

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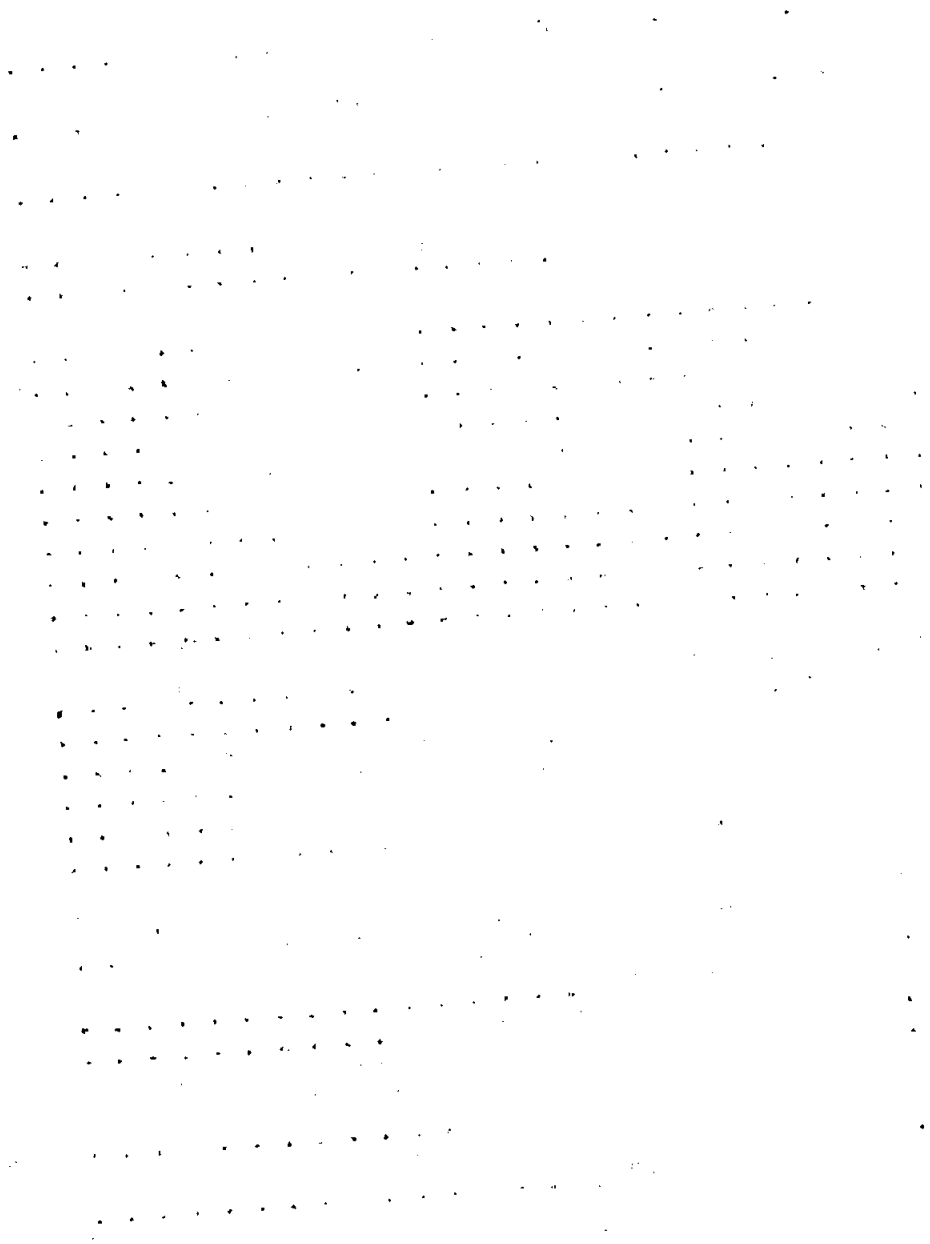

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MR. SWAREN: Vision and imagination are the essential characteristics of any engineer. But the conception of far-flung power transmission systems--bringing together the power created not by a single waterfall but by numerous waterfalls on many rivers, changing the regimen of the streams, and linking these with centrally located steam power stations to affect the destiny of an eighth of our Nation--requires not only vision and imagination but integrity as well. Our speaker today has all of these.

During the economic crises of the early 1930's it was common comment that the only sound asset of the power companies of the South was the integrity of the power-company employees. Our speaker was the engineering inspiration of these organizations.

With all of these material responsibilities, his public vision marched side by side. Nor was his patriotism or his courage less. During the last war there came a time when it was necessary to test a weapon of high potentialities against a real target. Our speaker put not a single target but an entire river system at the disposal of the military engineers.

He is familiar with many of the problems which you face, as the companies which he heads served during the last war a greater variety of military installations than did any other utility in the Nation.

It is a pleasure to welcome to this platform Mr. E. A. Yates, President of The Southern Company. Mr. Yates.

MR. YATES: Thank you very much.

It is a pleasure for me to be permitted to talk to you today. The subject suggested, "Power and the National Economy," is a very broad one. I have taken the liberty, therefore, of restricting my discussion to "Electric Power and the National Economy," as my experience has been in the field of electric power.

Because of the many statistics involved, I will read a prepared statement in the interest of accuracy. I have lantern slides to illustrate graphically some of the relationships between electric power and various aspects of the national economy. My statement, which is available for distribution to any of you who would like to have a copy, contains appendices which set forth the statistics underlying the various graphs used and explain the source of all such figures.

I have been in the utility business in the Southeast for the past thirty-five years and have been closely associated with the power development of the area. I am President of The Southern Company which is a holding company, and its member subsidiaries are Alabama Power Company, Georgia Power Company, Gulf Power Company in Florida, and Mississippi Power Company. The Securities and Exchange Commission has approved The Southern Company as a holding company, based on the fact that the four operating subsidiaries are in contiguous states and the power facilities have been developed and are operated as a unit under centralized control and form a truly integrated situation.

In order properly to appraise the present position of electric power in our national economy, I think we should first look backward to the time, not very many years ago, when electric power was an almost insignificant factor in our national life; then follow its evolution, gradual at first, later steadily increasing in tempo, until by the end of 1947, more than 70 percent of our total industrial capacity was powered from central station sources.

The electric power industry may be considered to have had its beginning in 1882--at which time the Pearl Street Station in lower New York City began operation. This was the first commercial central station. It had an installed capacity of 560 kilowatts and served a small area of the City with direct current energy.

Transmission of direct current energy for any great distance was not feasible and it was not until 1886, with the introduction of the transformer by William Stanley, that there became available a means of changing the voltage of alternating current and thus permitting the transmission of energy over greater distances. It was not until 1908 that the development of insulation for high voltages had been perfected and transmission at voltages as high as 100,000 was successful, making it possible to generate energy at one place and transmit the power for use at a remote point.

Reliable nationwide statistics as to the extent to which the electric industry had been developed by the year 1907 are not available, but the history of the service area of The Southern Company System may be considered more or less typical of conditions elsewhere in the country at that time and it is available.

Map 1, page 16, shows the generating and transmission facilities in that portion of the Southeast now served by The Southern Company, as those facilities existed in 1907. The crosshatched areas as indicated on this map are the present service areas of the operating subsidiaries of The Southern Company. From left to right, the crosshatched area in Mississippi is the present service area of Mississippi Power Company; the crosshatched

area in Alabama is the present service area of Alabama Power Company; the crosshatched area in Florida is the present service area of Gulf Power Company and the crosshatched area in Georgia is the present service area of Georgia Power Company. None of these companies was in existence in 1907. You will notice the numerous black squares and black circles which cover the territory rather completely. These represent generating stations, the squares being fuel plants and the circles being hydroelectric stations. In 1907 there were approximately 160 small generating stations. In many instances service during the daytime was not provided by these plants. It is interesting that although the feasibility of power transmission at low voltages had been established by the installations in California and Oregon more than a decade previously, very little progress toward the development of transmission systems had been made in the Southeast. You will note that transmission lines in the area in 1907 were practically nonexistent.

It is noteworthy that even such rudimentary transmission systems as did exist confined their operation to very small geographical areas. Only a few communities were served by any one system, and in some instances more than one company served a single community. The restriction of these early systems to such limited areas of operation may be attributed to two factors. In the first place, the technological advances which made possible the economic generation of power in large quantities and the transmission of that power at high voltages had not been made in 1907. Secondly, the electric business was a new and strange enterprise and many of the companies engaged in it were beset by continuous financial difficulties.

By way of contrast with the 1907 map I show you now a 1948 map of the service area of The Southern Company showing generating stations and transmission lines (map 2, page 17). It will be noted that by 1948 coverage of the area by the transmission network was practically complete. Over this forty-year period installed generating capacity in the area has grown from 75,643 kilowatts in 160 small plants of less than 500 kilowatts average capacity to 1,381,814 kilowatts in 46 plants of about 30,000 kilowatts average capacity. In this period the development of the industry forced the scrapping of about 200 small inefficient plants in the area. You will see that the numerous isolated generating stations have disappeared and have been replaced by large hydro plants and modern high efficiency steam stations.

Electric power has developed into a present-day necessity. It has been an important factor contributing to the Nation's industrial supremacy and has had a tremendous influence upon the pattern of national development. With the extension of electric transmission, factories were freed from previous restrictions as to location. No longer was every cotton mill necessarily located on the bank of a New England stream, while other sections of the country pursued a one-sided agricultural life. Widespread

availability of electric power makes it possible for mills and factories to locate almost anywhere, taking advantage of favorable labor, transportation and market conditions, and at the same time introducing industry into many communities formerly entirely agricultural. The sociological and economic consequences of such decentralization of industry have surely altered the course of American civilization, and for the better.

Chart A, page 18, shows the growth in installed generating capacity of the privately owned companies and the public agencies from 1902 through 1947.

As might be expected, the growth of the electrical industry has closely paralleled that of various indices of our national economy. For example, chart B, page 19, compares the energy generated and total bank deposits. Since the turn of the century the curve of generation has followed rather closely that of bank deposits. You will notice that bank deposits dropped off during the depression of the 1930's to a greater extent than did generation, which is evidence of the inherent stability of the utility industry. The changeover from war production to peacetime activities interrupted the increase in generation for two years but the latest figures indicate that electric generation is again rising approximately parallel with bank deposits.

Chart C, page 20 , similarly compares energy generated with gross national product. You will see that the curve of generation corresponds closely with that of gross national product. Again, the stability of the electric industry is attested by the fact that the depression of the 1930's caused a smaller decrease in generation than in gross national product. It is true that gross national product, being expressed in dollars, is affected by price levels. Another curve, which I shall show you in a moment, in terms of production index, eliminates the effect of price changes.

As a matter of interest, Chart D, page 21, compares energy generated with life insurance in force. The stability of the life insurance industry produces a smoother curve with less pronounced dips and crests than appear in the curve of generation.

Chart E, page 22, compares energy generated with the Federal Reserve Board index of industrial production, from its inception in 1919. The dotted curve showing the Federal Reserve Board Index of industrial production is expressed in terms of production volume and not production value. It therefore does not reflect price fluctuations. Generally, there is close relationship between the two curves over the entire period. The low points in the F.R.B. index curve in 1932 and in 1938 have their counterparts in the curve of generation as does the 1946 postwar low. The stabilizing influence of the residential, rural, and commercial business of the electric industry, however, is responsible for the fact that the valleys in the generation curve are less pronounced than those in the production index curve.

You will note from all of these charts a striking parallel between the energy generated and the various indices of national growth and prosperity.

Chart F, page 23, compares the Federal Reserve Board index of industrial production with the energy sales of private utility companies and public agencies to large light and power customers. As might be expected, these two curves correspond even more closely than the others.

Chart G, page 24, shows the productivity (in terms of output per man-hour) of workers in all manufacturing industries over the period for which statistics are available. These productivity data are expressed in index numbers, based upon 1939 as 100 percent. On this same chart there appears a plot of energy sales to large light and power customers per man-hour worked in all manufacturing industries, this also being expressed in terms of index numbers, based upon 1939 equals 100 percent. (Details of this computation appear in Appendix D.)

The striking similarity of the two curves of Chart G demonstrates clearly that increased output per man-hour worked in manufacturing industries has gone hand in hand with increased energy sales per man-hour worked. In this connection let me quote a statement by Dr. J. Frederick Dewhurst, Chief Economist of the Twentieth Century Fund, who said:

> "Over the past century we have achieved a fabulous increase in output per man-hour, not by working harder or more skillfully, but by constantly devising new and better machinery to augment human effort by the use of vast amounts of inanimate energy." As quoted in "Electric Utility Financing," Ebasco Services, Inc., October 1948.

Industrial workers increased in number 50 percent in the period 1926 to 1947, while the Federal Reserve Board index of industrial production increased 95 percent and the total energy purchased by industrial customers increased 25 percent. The energy utilized per man-hour increased from 1.65 kilowatt hours to 4.20 kilowatt hours. (For details, see Appendix D.).

The increase in the amount of electric energy used by industry has an important bearing upon the place of electric power in the national economy. Shortage of skilled labor, high labor rates, and decreasing hours of the work week forced industry to find new ways of performing its various operations by increasing mechanization.

We have seen to what a great extent industry depends upon the present power system. Our homes, farms, stores, hospitals, transportation, communication--indeed practically all activity has become so closely dependent upon electric energy that life without it would be hard to imagine. Such reliance on the product of a single industry makes it imperative that there be no impairment of that industry's capacity to serve.

Having added 50 million kilowatts to the two and three-fourths million kilowatts of generating capacity which were in operation in 1907, and having similarly increased transmission and distribution lines and substations, one might have expected the end of 1947 to find the electric industry in a position to rest upon its oars for a while and to wait for the loads to catch up with the new construction. Instead, the industry is now engaged in the greatest construction program in its history--one which will require the expenditure by the privately owned companies alone of 6 billion dollars by the end of 1951 or early 1952.

To raise the funds necessary for financing a program of this size, the companies must offer the investing public a fair return upon invested capital. Rates in the industry as a whole have been decreasing for more than twenty years, yet there have been, particularly in recent, substantial increases in the cost of materials, equipment and labor.

In the attraction of capital, the question of earnings is fundamental. I think most regulatory commissions fully recognize that adequate expansion of utility facilities, so essential to the progress and welfare of the areas served, is dependent upon a fair return on the capital invested and that regulatory statesmanship must see that relief is granted in those cases where increased fuel, labor and material costs cannot be absorbed.

New electrical loads having considerable promise are being developed on the utility systems. Air conditioning, for example, has not yet attained the importance as a utility load which I believe it will attain in the future.

The so-called "heat pump"--a reverse cycle refrigeration system, suitable for summer cooling and winter heating of residences and stores, is still in its infancy, but when you realize that energy consumption of 10,000 kilowatt hours per year may be expected from the average heat pump installation, you will see why I think the heat pump may become very important to the utilities.

The future of the utility industry, like the future of every other industry, has some aspects that are less bright than others. The utilities like other industries, are in an era of high costs. Unlike other commercia enterprises, the industry can pass on such increased costs to the users of its service only with the approval of regulatory commissions, and usually only after extended hearings. It has been necessary in many instances, and may become necessary in still other instances, to apply for increases in rates. While some of the rate increases thus far granted have been less than the utilities had asked, I think in general the regulatory agencies having jurisdiction over rates have been realistic in their approach to the problem. In those instances where compensatory increases have not yet been granted I think it is urgently necessary that the regulatory bodies give careful consideration to the necessity for such

increases. The tremendous construction program in which the utility industry is engaged cannot be financed entirely by means of cash generated within the business. New money from the investing public must be put into the industry. In securing such funds the utilities must compete in the money market with other industries seeking new money. And the investor very naturally will not put his funds into the utility business, unless he expects that such funds, under good management, will earn a reasonable return.

The impact of World War II upon the utility industry was felt in many ways, the most spectacular of which was the unprecedented increase in the loads these systems were called upon to carry. Existing industries, great and small, converted to war production, stepped up their operations to three shifts, and in many instances increased their manufacturing facilities. Numerous war industries sprang up and a multitude of army camps, flying fields, and other military loads came into existence almost overnight. How well the demands for power for war were met by the utilities is a matter of history. I think the public never realized the magnitude of the wartime accomplishments of the utility companies, but accepted them as a matter of course.

In this connection it may be of interest to consider the amount of war load carried by the utilities during World War II. The Federal Reserve Board has prepared a breakdown of its industrial production index as between war industries and civilian industries.

It is interesting to note that a graph of the wartime sales to large light and power customers and other public authorities follows closely the graph of the Federal Reserve Board index of production. Chart H, page 25, shows this comparison. Accordingly, from the Federal Reserve Board breakdown of the production index between war and civilian functions, a breakdown of sales to large light and power customers and other public authorities was obtained; based upon this breakdown, a division of total generation between war and nonwar purposes was obtained. Appendix E, page 37, shows the details of the calculation and chart I, page 26, is a graphical expression of the energy generated for war purposes.

Chart I clearly shows the gradual build-up of the defense effort in the years 1939 and 1940 when generation for war purposes was, respectively, 1 percent and 3 percent of the total. By 1941 war generation amounted to 11 percent of the total. Up through 1941 there was no actual decrease in civilian generation but merely a slowing down of the rate of growth of civilian load. In 1942, however, there was a pronounced reduction in generation for civilian purposes and a corresponding increase in war generation, the latter amounting to 31 percent of the total. Civilian energy stayed at about the 1942 level in 1943 and in 1944, the war energy in the latter two years being 42 percent and 41 percent, respectively.

Note that even after curtailment by demands of war, the generation for civilian use in 1943, its lowest wartime point, was about equal to the total 1939 generation and well above that for any previous year.

In this connection it is interesting that the total national defense expenditures expressed in percentage of gross national product were approximately as follows: (National Industrial Conference Board Road Maps of Industry No. 645, 7 May 1948.)

	Percent		Percent		Percent
1941	5	1943	36	1945	40
1942	15	1944	40	1946	22

With the end of the war in 1945 war loads dropped off, the percentage of war generation decreasing to 29 percent, and the civilian generation rising to a new high. The 1946 figures reflect an almost complete elimination of war activity, there being only 3 percent of the total generation attributable to the war.

The four electric utility companies which comprise The Southern Company group serve about 750,000 customers directly and about 350,000 indirectly. Their service areas embrace a region of about 94,000 square miles in the heart of the deep South.

By the end of 1951 they will have added since 1940 approximately 1,200,000 kilowatts of high economy steam plants on the integrated system, more than doubling its generating capacity.

The electric facilities of these four companies have for more than twenty years been operated as an integrated system. Their production plant and transmission systems have been planned, constructed and operated on an integrated basis, although each company is separately responsible to its customers, security holders, and local regulatory agencies. The transmission facilities of the four companies are connected to their generating plants and other sources of power and are interconnected with the transmission facilities of the other utility companies by means of heavy duty, high voltage lines in such a manner that, in effect, power generated at any point on the entire interconnected Southern Company system may be utilized at any other point. Additional interconnections make available power from neighboring utilities. Coordinated operation of the entire interconnected system of these companies is conducted through a central load-dispatching agency. All generating stations on the entire system are regularly scheduled for operation in ascending order of their operating cost. Reserve capacities for the entire system are pooled and the total amount thereby reduced. The available sources of energy are so utilized as to make available to these companies the most economical sources of power consistent with good operation.

You may be interested in seeing some of these plants. In addition to its steam plants Alabama Power Company has six hydroelectric developments, three on the Coosa River and three on the Tallapoosa.

The Martin Dam and powerhouse, page 28, are on the Tallapoosa River. Installed capacity at this plant is 99,000 kilowatts. The dam impounds a 40,000 acre lake, so that water is stored during the rainy season and released during the dry season. Water released at this plant becomes available for generation at the downstream plants namely, Yates Dam and Thurlow Dam.

The Jordan Dam, page 28, is the largest of Alabama Power Company's hydro developments. This plant is on the Coosa River. It has 100,000 kilowatts of installed capacity.

Alabama Power Company's Gorgas No. 2 steam plant, page 29, is located in the coal fields near Birmingham. Its present capacity is 120,000 kilowatts, and a new 100,000 kilowatt unit will be completed here in 1951.

Georgia Power Company, page 29, has 12 relatively small run of river hydro plants and 10 storage plants, the largest of which is the Tallulah Falls plant on the Tallulah River in northeast Georgia. This plant is shown here. Its installed capacity is 72,000 kilowatts and it is one of five plants on the Tallulah and Tugalo Rivers, which utilize the entire fall of 1,199 feet in that portion of the stream and completely regulate the flow.

The Bartletts Ferry plant, page 30, is on the Chattahoochee River. Its present capacity is 45,000 kilowatts, and the plan is to increase it by the addition of another unit, to 60,000 kilowatts.

Plant Atkinson, near Atlanta, is shown on page 30. A 60,000 kilowatt unit was added in this plant last November and its present capacity is 240,000 kilowatts.

There are also new steam plants in Pensacola, Florida, and Hattiesburg, Mississippi, and additional units are being installed in each of these plants.

In order that this southern group might be permitted to continue under one ownership it was necessary to prove before the Securities and Exchange Commission that it was a truly integrated operation and conformed to the provisions of the Public Utility Holding Company Act.

On 1 August 1947 the Commission issued its order approving the retention of these companies under the ownership of The Southern Company. In its order the Commission said:

"According to the record, there are substantial savings in operating costs and fixed charges resulting from coordinated planning and operation. Power supply economies are achieved through sharing of reserve capacity and through joint planning of generating facilities so as to stagger construction and cause facilities to be erected at the sites of cheapest operation irrespective of corporate limits. Further power supply economies result from central load dispatching whereby, by the control of reservoirs, run of river and fuel-electric plants, substantial amounts of water which might otherwise be wasted are conserved and thereby the need for additional generating facilities with accompanying fixed charges is averted or delayed."

As a part of our presentation to the Securities and Exchange Commissi we prepared analyses based on a study of all utility operating companies east of the Mississippi River using basic data from Federal Power Commission reports. In this study we compared six main groups, each composed of companies which were developed and operated as fully integrated systems with the approximately 90 remaining operating companies.

The results of this study are shown on page 27, as chart J, and indicate:

1. That the reserves required by the integrated groups were less than the independent groups.

2. That the average annual load factor of the integrated group was higher than that of the independent groups.

3. That the utilization of equipment (or work accomplished per unit of capacity) was 24 percent higher with the integrated groups than with the independent groups.

The marked improvement of both groups in the Year 1943 shows the effec of cooperative pooling between the companies. The War Production Board was very active in advancing the extent of the pooling.

If the remaining companies east of the Mississippi River in 1943 could have operated at the use factor achieved by Group "A", there could have been a saving of several million kilowatts of generating capacity.

The great value of integration and pooling was recognized during the First World War. In December 1919, Colonel Charles Keller, of the Corps of Engineers, submitted to the Secretary of War a report advocating the interconnection of existing power systems so as to form a number of so-called power "districts" and recommending that their power resources be supplemented through the development of water power at certain advantageous locations and the construction of large steam plants.

Colonel Keller's report led to further studies by seven independent companies in the Southeast. As chief engineer for this group I made studies of prospective load growth in the area, means of producing the anticipated requirements and methods of joint operation to secure maximum reliability of service and other benefits from coordination of operations. These studies indicated that joint development and joint operation, as compared with independent development, would greatly reduce the amount of capacity required to serve the anticipated loads and effect very substantial savings in annual operating costs. The studies were completed in June 1920, and later five of the seven participating companies became integrated under ownership of The Commonwealth & Southern Corporation, of which present holdings in the South are owned by The Southern Company.

The economies effected by integration which I have described may not, in a dollar sense, be of particular significance in time of war. The saving in time, in critical materials, in manpower might well be vital.

In February 1943, J. A. Krug, then Chief of the Power Branch of the War Production Board, said:

> "Power pooling has been another immensely important factor in assuring an adequate power supply. Starting with the experience in the Southeast during the serious drought of 1941, the War Production Board has developed, in cooperation with major power systems, vast power pools for each critical power supply area of the country. You are well acquainted with the pool which operated in the southeastern states so effectively during the critical months of 1941 and which can be called upon again at any time to assist power systems throughout the South. Similar pools have been established in the southwestern states, including Texas, Arkansas, Louisiana, and Oklahoma; in the far West, including California and Arizona; in the Northwest, where the great Bonneville Power System serves as a backbone for integrating all of the facilities of the region; and in the Middle West and in New England. You will be interested to know that through these pools alone, at least one and a quarter million kilowatts of additional firm power supply has been assured."

World War II has given the industry an invaluable lesson in pool operations and integration and should this Nation become involved in another war, or in national defense activity of emergency proportions, I am confident the pooling of facilities will greatly exceed that accomplished during World War II.

QUESTION: Will you comment, Mr. Yates, on the current expansion which you indicated is taking place? That expansion seems to me to be largely in steam plants rather than in hydro plants. Since steam is more expensive, do you feel that the hydro expansion in that territory is pretty well exhausted, or is the expansion in steam plants due to other reasons?

MR. YATES: In 1911, 1912, and 1913 there was quite a movement in building hydro plants in Tennessee, Georgia, and Alabama. Predecessors of the Georgia Power Company built plants in North Georgia; two plants were built near Columbus, Georgia; and a plant was built near Augusta, Georgia. A number of plants were built in Tennessee, and the first plant was completed on the Coosa River, under congressional grant, in 1914. Now there are six large plants in Alabama, this string of plants in North Georgia of the Georgia Power Company, and there are the two plants of the Georgia Power Company near Columbus, Georgia.

The Georgia Power Company now has a license from the Federal Power Commission to complete a dam and powerhouse on the Oconee River near Milledgeville, Georgia. It was started in 1928 and stopped during the depression. Now they expect to start on it again.

There are some hydro plants that we would like to build. You may have heard of Clark Hill. A subsidiary of The Southern Company owns the Clark Hill site near Augusta. It is a beautiful site. We had bought about 40,000 acres of land to flood, but at the present time it is being built by the Army. While we had filed an application with the Federal Power Commission for a license, it was refused and we have stepped out.

The Government will complete, I believe next year, the Allatoona development on the Etowah River near Rome, Georgia. A hydro plant is under construction on the Chattahoochee River near River Junction, which is just below the Georgia line, and there is talk of other developments on the Chattahoochee.

Of course, our companies have not built any hydro plants recently because the TVA and the Government are building about all of them. We have built nothing since the last one was finished in 1930. That is the Thurlow Dam.

We have worked out a contract to buy the power at Allatoona from the Government, and we work very closely with TVA. We have three high-voltage tie lines to TVA in Alabama and Georgia and are building another tie line. We interchange power and carry the peaks back and forth. We give them energy at night and Sundays which they put in their reservoirs and convert for us. At times we call on them and they call on us. It has been a very advantageous arrangement for both parties.

We would like to build more hydro plants, but the Federal Government is doing about all that work now.

QUESTION: Mr. Yates, one of the arguments brought by proponents of publicly owned power companies is the fact that regulation has been ineffective. Yet the same people who say that regulation is ineffective turn right around and say that the Government, which can't regulate, can own and operate a power company. Can you help me reconcile these two views?

MR. YATES: I think that the regulation to which these companies are subject, so far as rates are concerned, has been effective. So far as securities are concerned, we can't sell securities without the consent of the Securities and Exchange Commission.

QUESTION: Is the matter of interchange of power between various companies or holding companies a financial one in the long run, or do you simply loan them so many kilowatt hours and they give them back to you?

MR. YATES: There have been cases where power has been carried from New Orleans up to Virginia. It has been relayed over these systems. In the 1941 situation, under the direction of Mr. Krug, the generating facilities of practically all the companies--Southern, Virginia, the TVA, those in Florida, and our properties--were pooled and all worked together. Now, generally speaking, we have arrangements to buy power from the TVA, a certain amount of firm power. One such contract will expire the latter part of this year. We also have arrangements whereby they will give us power or we will give them power; if there is a saving in that we can give them water power and they can shut down steam, or vice versa, we split the savings. On power that we might buy from Florida or Savannah or New Orleans, or which we might sell them, there is generally a rate established and a payment is made for the power.

QUESTION: Mr. Yates, it appears that in any future emergency we will probably have a critical manpower shortage. I would like to ask your opinion as to how many male employees of the power industry, of the power plant and distribution system, could be replaced by women in the event of an emergency.

MR. YATES: Of course, we have a great many women in our organization. We have quite a number in our drafting room. I couldn't say. We have about 12,000 people in the group down there. I wouldn't like to say how many, but I should think quite a number of women could be used. We use a great many now.

QUESTION: Mr. Yates, in your lecture you pointed out that the integrated power system is some 24 percent, I believe, more effective than are the independent power companies. It would appear that in a national emergency there would be a bigger cushion of available power from our independent sources. Could that power be utilized effectively?

MR. YATES: I think Mr. Krug answered that. With the power pooling they had during the last war, he said they saved some one and a quarter million kilowatts of capacity. There isn't any question that capacity is saved by pooling. If they could completely integrate these 80 or 90 independent companies or companies that are not a purely integrated

operation, they would save capacity; but I don't believe that can be done. A great deal can be done by pooling under government supervision, there is no question about it, in case of emergency.

QUESTION: We hear of the current power shortage. Particularly, the aluminum people seem not to be able to get the power they want in order to expand. Would you indicate what is holding up the expansion of capacity?

MR. YATES: It is the delivery of equipment. We have some equipment we won't get until the latter part of 1951 or early in 1952. On top of that, everybody expected there would be a lag after the war in the growth of demand for electricity. As a matter of fact, it has just gone right on up. We were awfully close in the war. I know that in our particular group we had some units on order that were really taken away from us to serve more critical areas, and we never quite caught up.

We have about 600,000 or 700,000 kilowatts of high-economy steam now being built in Pensacola; Mobile; Hattiesburg, Mississippi; Meridian; Gadsden, Alabama; Albany, Georgia; and Newman, Georgia; and we hope that by 1951 we will have a reasonable leeway over our demands. It is awfully close now. I think it is pretty close all over the country.

QUESTION: Has a system been devised whereby you can transfer power from any point in the United States to another?

MR. YATES: On one or two occasions it has gone as far as from New Orleans up into Virginia when there has been some trouble up there, but I wouldn't say that it could go from one part of the United States to another It does go long distances, however, and it is largely by relaying. For example, if New Orleans wanted to send power to Virginia for some reason, it would be relayed by New Orleans power being used in Mississippi power being used in Mississippi and Mississippi power being used in Alabama and pushed on in that way. The power that originated in New Orleans would not get to Virginia, that is, not the identical power.

QUESTION: Mr. Yates, what is the approximate average time between the placing of an order for heavy equipment and the delivery of it?

MR. YATES: I think it is about two and a half years.

QUESTION: What is your present load factor approximately?

MR. YATES: Our present load factor is 62.8 percent. It has dropped since the war.

QUESTION: We hear from the soil conservationists that our rivers are all being silted up. Would you care to comment on the future outlook in

respect to the effect on the equipment, that is, turbines, as well as the silting up of the lakes in the distant future?

MR. YATES: I think the runoff in the last 40 years has increased largely due to the fact that the forests have been denuded and the soil has been washed away. The one thing I could say about that is that a year or so ago I went through the basin of Martin Reservoir. That is a very large reservoir, and, of course, silting is there. I went over the work that was being done under the supervision of the Department of Agriculture and the county agents in the way of planting grasses, such as Sericea and Lespedeza, and attempting to change the character of the product largely from cotton to diversified crops. I saw that even one of the milk companies had put in a big creamery there because they were getting very definite results and they were raising very much more cattle. They were planting these grasses; and when you do that, you get away from much of this erosion.

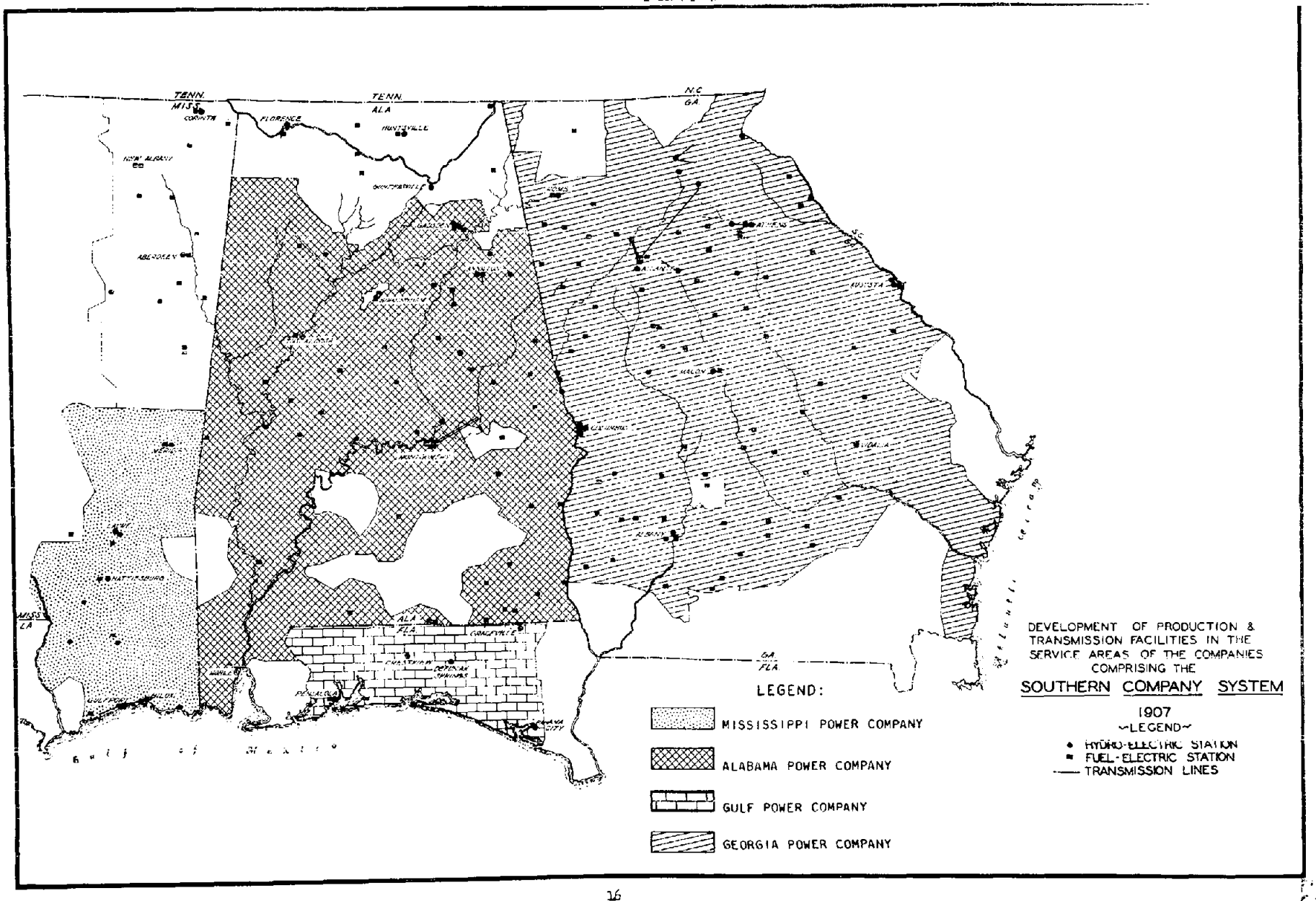
I have a friend who has a farm north of Atlanta. He bought the farm about 10 or 12 years ago. Most of you have seen, I think, the red soil in Georgia and the erosion. His place was badly eroded. He got bull-dozers in there, he leveled off his fields, limed them, and planted these grasses. His farm not only turned into a beautiful place, but it has become very productive. That shows what can be done to reclaim these lands.

Of course, in Georgia and in Alabama a great effort is being made by different groups to diversify and prevent this erosion. It is just a matter of building up the territory. I believe it will be very helpful also in decreasing silting in these reservoirs.

COLONEL HORNOR: Mr. Yates, I want to thank you at this time for a most interesting and instructive lecture. We feel we have gained a great deal from your talk in the way of understanding power.

MR. YATES: Thank you very much, sir. It has been a great pleasure to be here.

(14 February 1949--750)S.


TENN.
MISS.
TENN.
ALA.
N.C.
GA.
FLORENCE
HUNTSVILLE
ABERDEEN
MISS.
LA.
ALA.
FLA.
GA.
FLA.
LEGEND:
MISSISSIPPI POWER COMPANY
ALABAMA POWER COMPANY
GULF POWER COMPANY
GEORGIA POWER COMPANY
DEVELOPMENT OF PRODUCTION & TRANSMISSION FACILITIES IN THE SERVICE AREAS OF THE COMPANIES COMPRISING THE
SOUTHERN COMPANY SYSTEM
1907
~LEGEND~
HYDRO-ELECTRIC STATION
FUEL-ELECTRIC STATION
TRANSMISSION LINES

RESTRICTED

MAP 2

RESTRICTED
RESTRICTED
TENN.
MISS.
TENNESSEE
ALABAMA
GEORGIA
N.CAR.
SOUTH CAROLINA
Gulf of Mexico
Atlantic Ocean
ALABAMA
FLORIDA
MONTGOMERY
ATLANTA
AUGUSTA
MOBILE
BIRMINGHAM
OPERATING COMPANIES
1 Alabama Power Company
2 Georgia Power Company
3 Gulf Power Company
4 Mississippi Power Company
LEGEND
Hydro-Electric Station
Steam-Electric Station
Transmission Sub-Station
Transmission Lines - 154 KV and 110 KV
Transmission Lines - 66 KV to 22 KV
Interconnecting Lines
Note: Facilities under construction indicated by broken lines
Map of
ELECTRIC PRODUCTION
AND
TRANSMISSION SYSTEM
OF
THE SOUTHERN COMPANY
Scale in Miles

CHART A

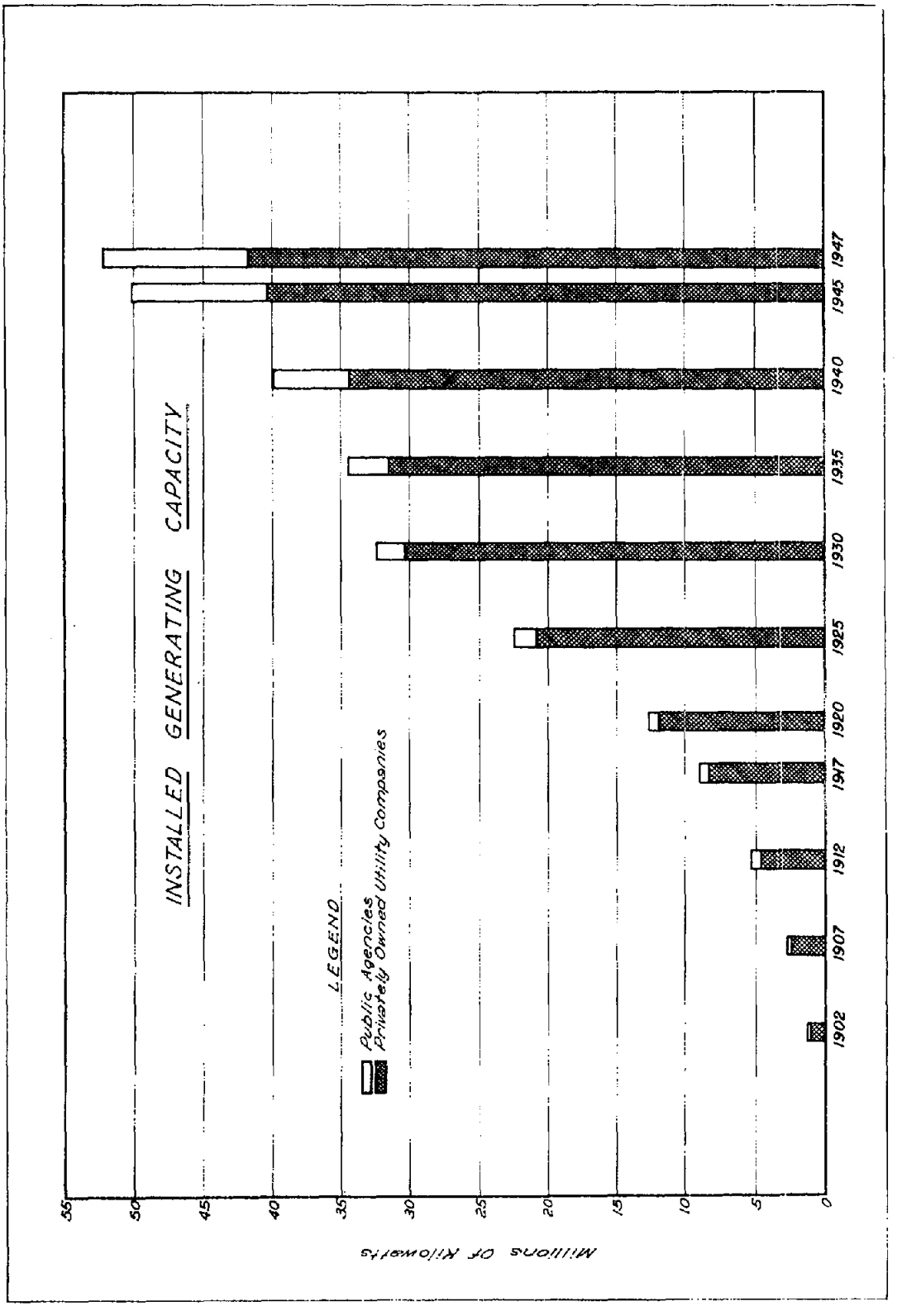

INSTALLED GENERATING CAPACITY
LEGEND
Public Agencies
Privately Owned Utility Companies
1947
1945
1940
1935
1930
1925
1920
1917
1912
1907
1902
55
50
45
40
35
30
25
20
15
10
5
0
Millions Of Kilowatts

CHART B

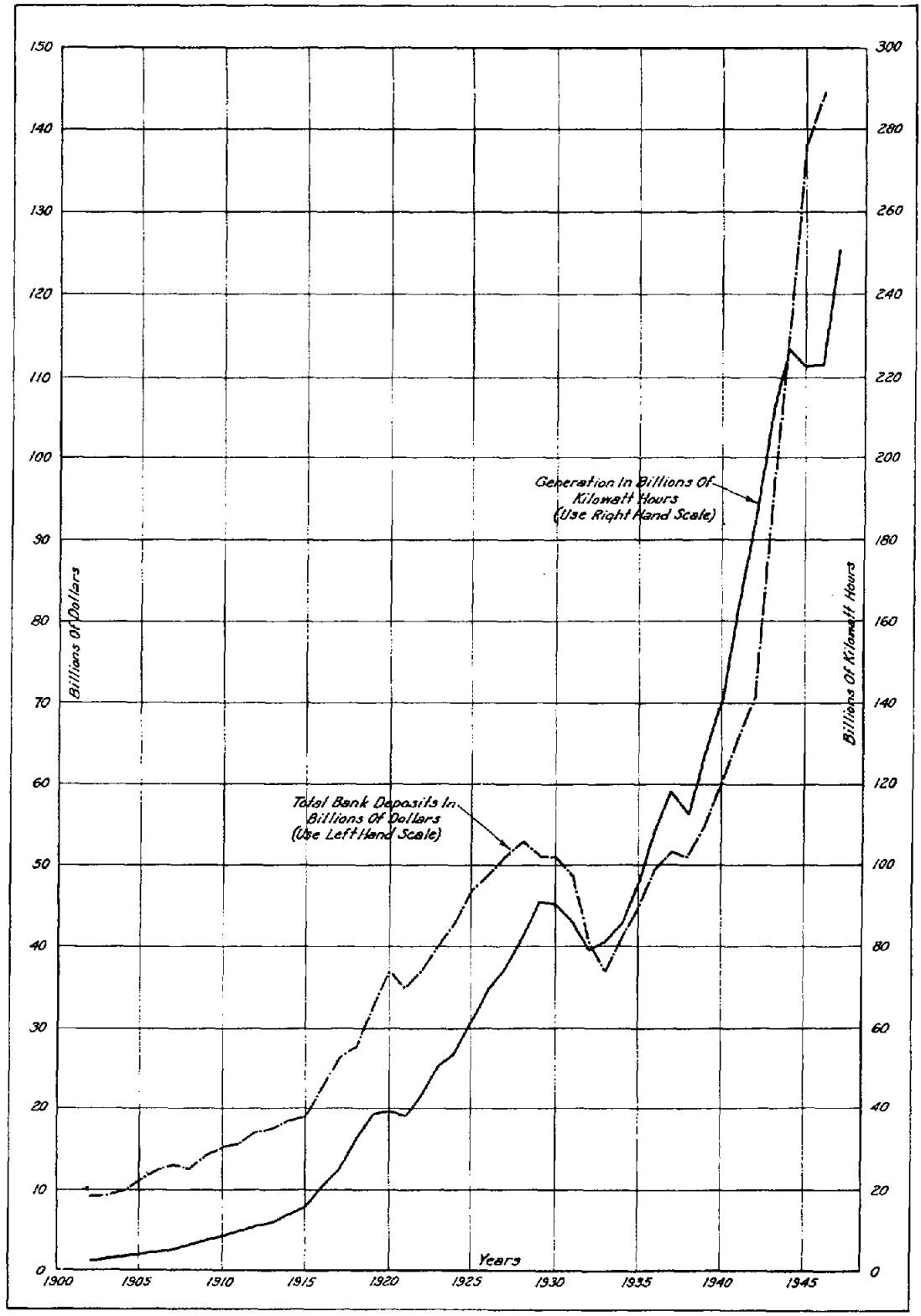

Billions Of Dollars
Billions Of Kilowatt Hours
Generation In Billions Of Kilowatt Hours (Use Right Hand Scale)
Total Bank Deposits In Billions Of Dollars (Use Left Hand Scale)
Years
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945

CHART C

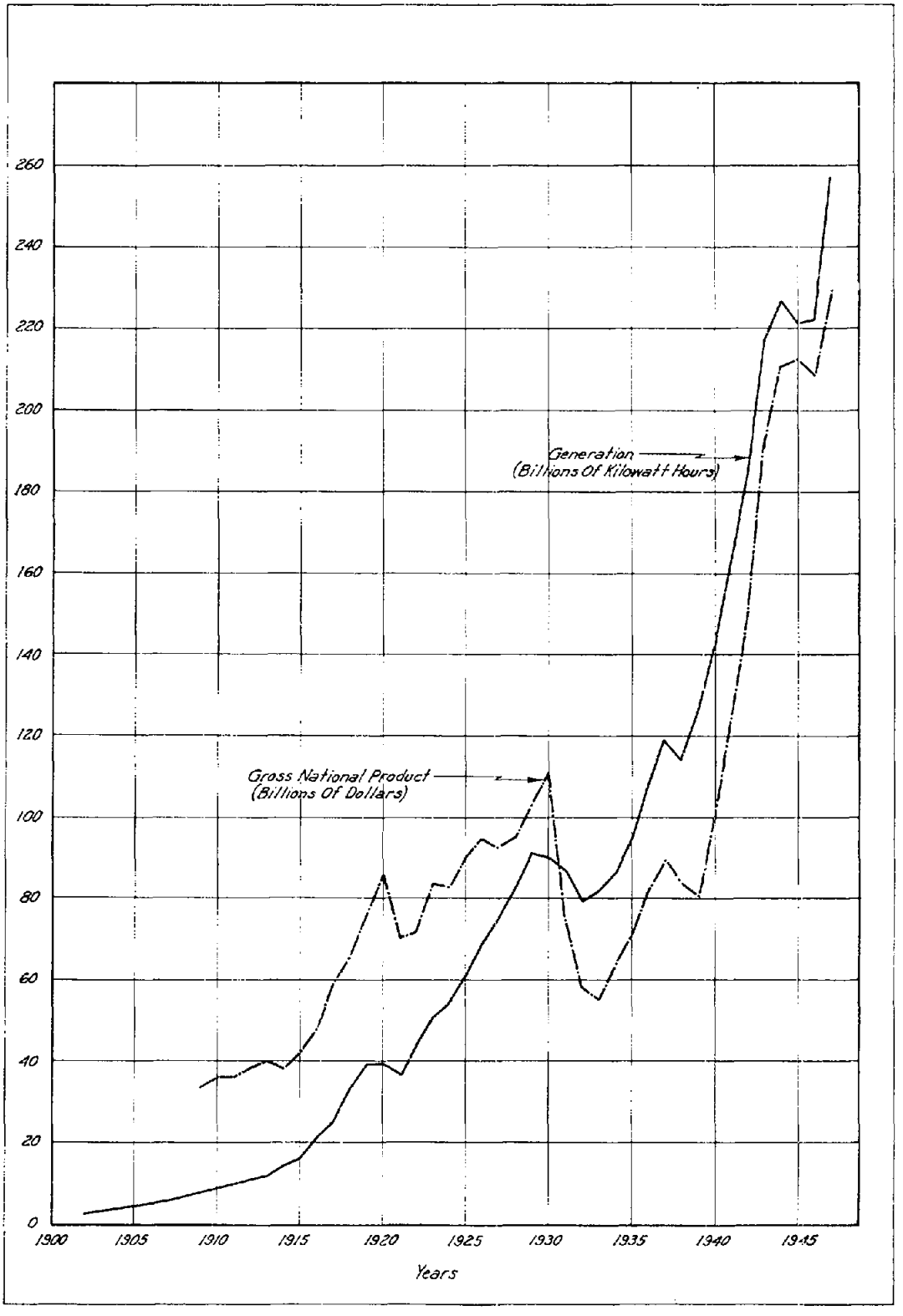

260
240
220
200
180
160
140
120
100
80
60
40
20
0
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
Years
Generation
(Billions Of Kilowatt Hours)
Gross National Product
(Billions Of Dollars)

CHART D

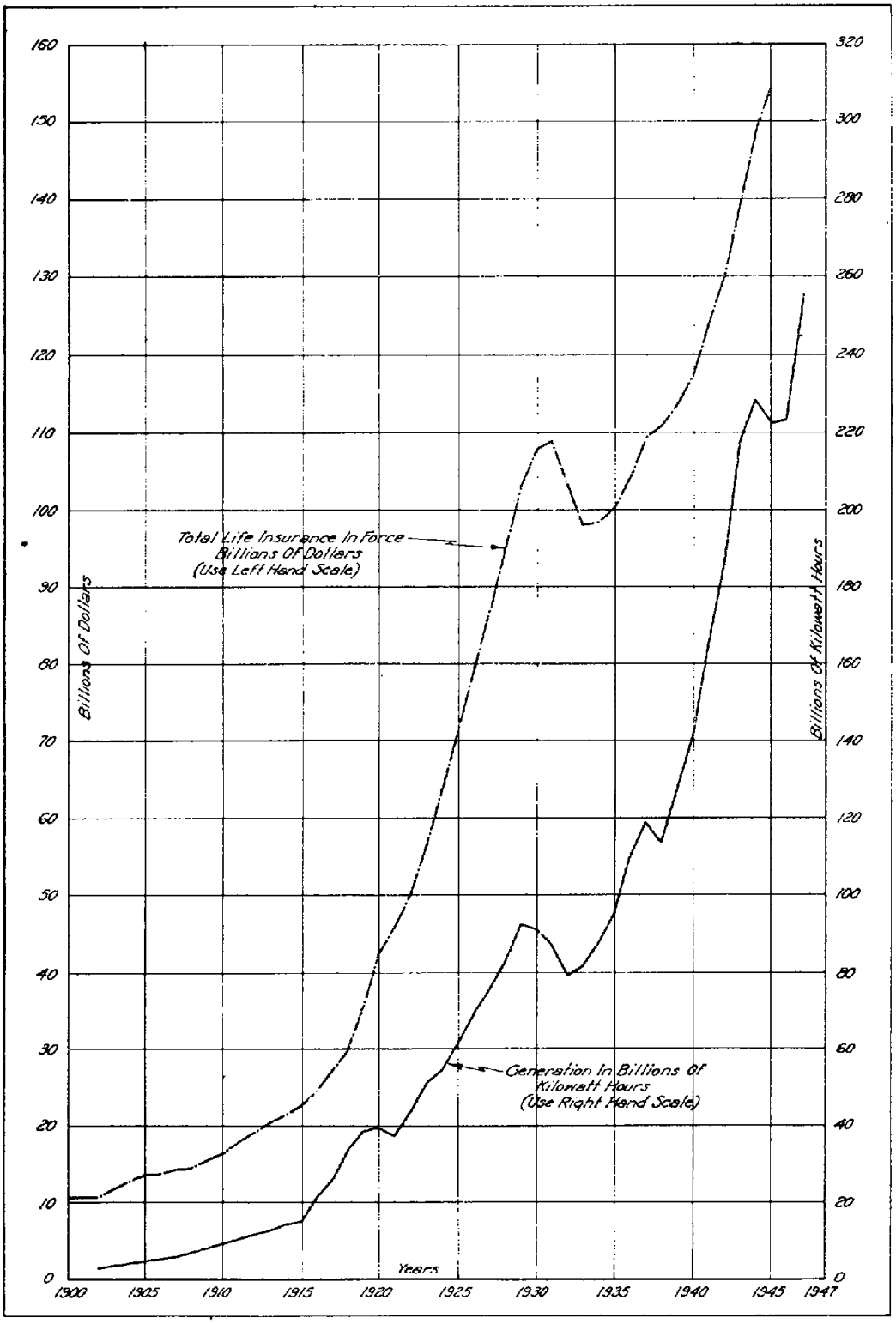

Billions Of Dollars
Billions Of Kilowatt Hours
Total Life Insurance In Force
Billions Of Dollars
(Use Left Hand Scale)
Generation In Billions Of
Kilowatt Hours
(Use Right Hand Scale)
Years
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1947

CHART E

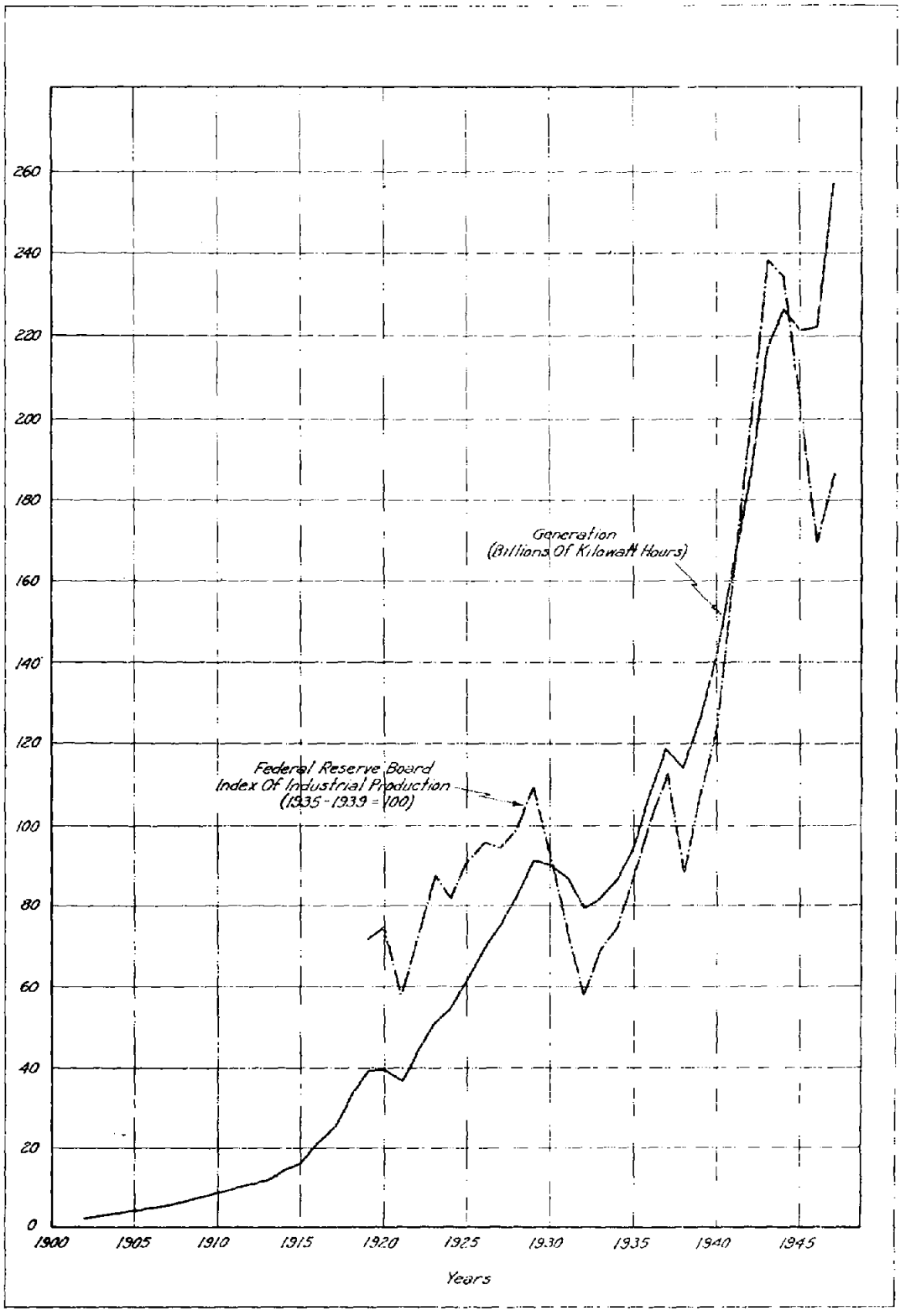

260
240
220
200
180
160
140
120
100
80
60
40
20
0
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
Years
Generation
(Billions Of Kilowatt Hours)
Federal Reserve Board
Index Of Industrial Production
(1935 - 1939 = 100)

CHART F

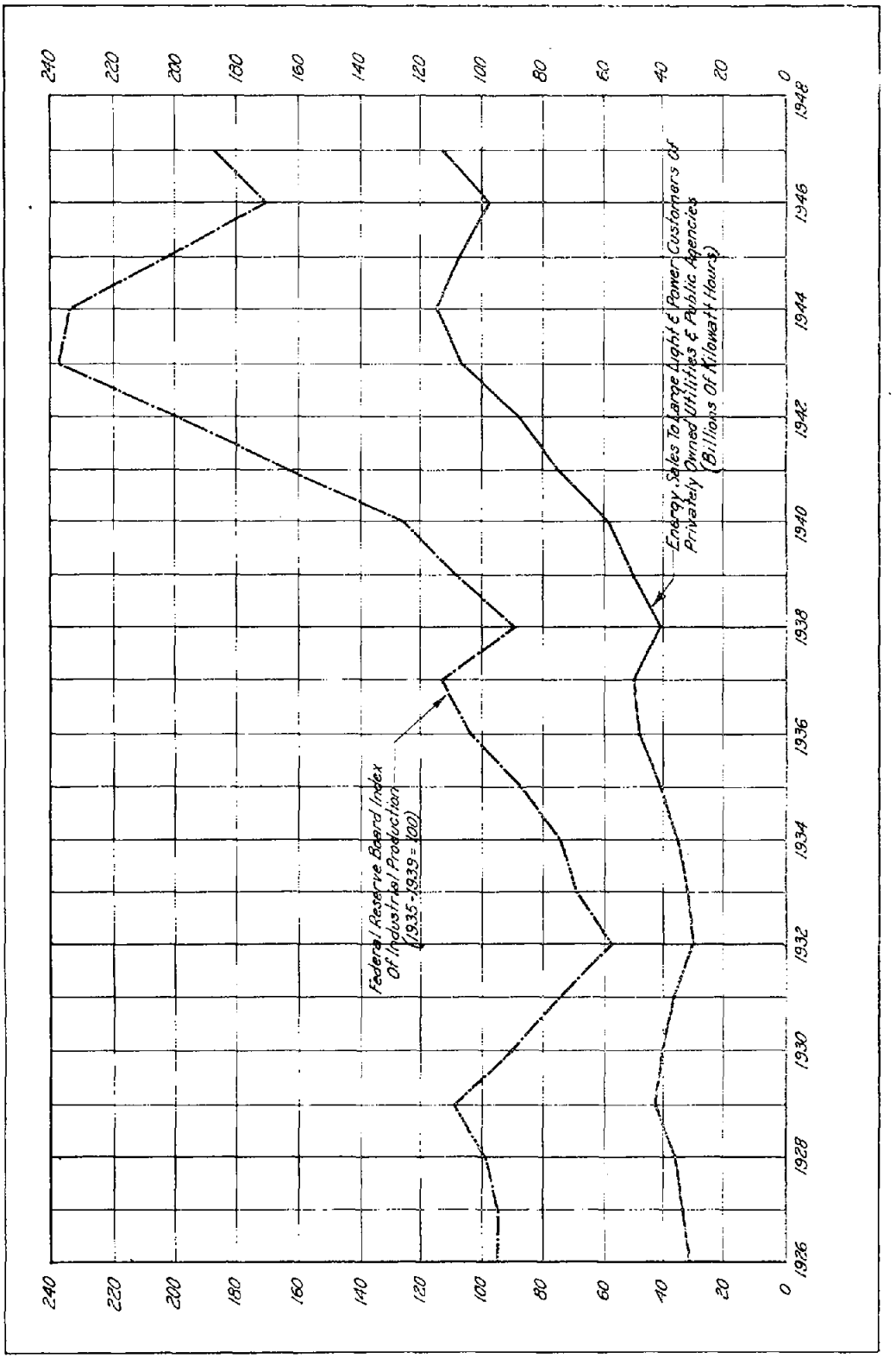

Energy Sales To Large Light & Power Customers Of Privately Owned Utilities & Public Agencies (Billions Of Kilowatt Hours)
Federal Reserve Board Index Of Industrial Production (1935-1939 = 100)
240
220
200
180
160
140
120
100
80
60
40
20
0
1926
1928
1930
1932
1934
1936
1938
1940
1942
1944
1946
1948

CHART G


150
140
130
120
110
100
90
80
70
60
50
40
30
Percent Of 1939
Energy Sales To Large Light & Power Customers Of Privately Owned Utilities And Public Agencies Per Man Hour Worked In All Manufacturing Industries
Out Put Per Man Hour Worked In All Manufacturing Industries
1926
1928
1930
1932
1934
1936
1938
1940
1942
1944
1946
1947
Years

CHART H

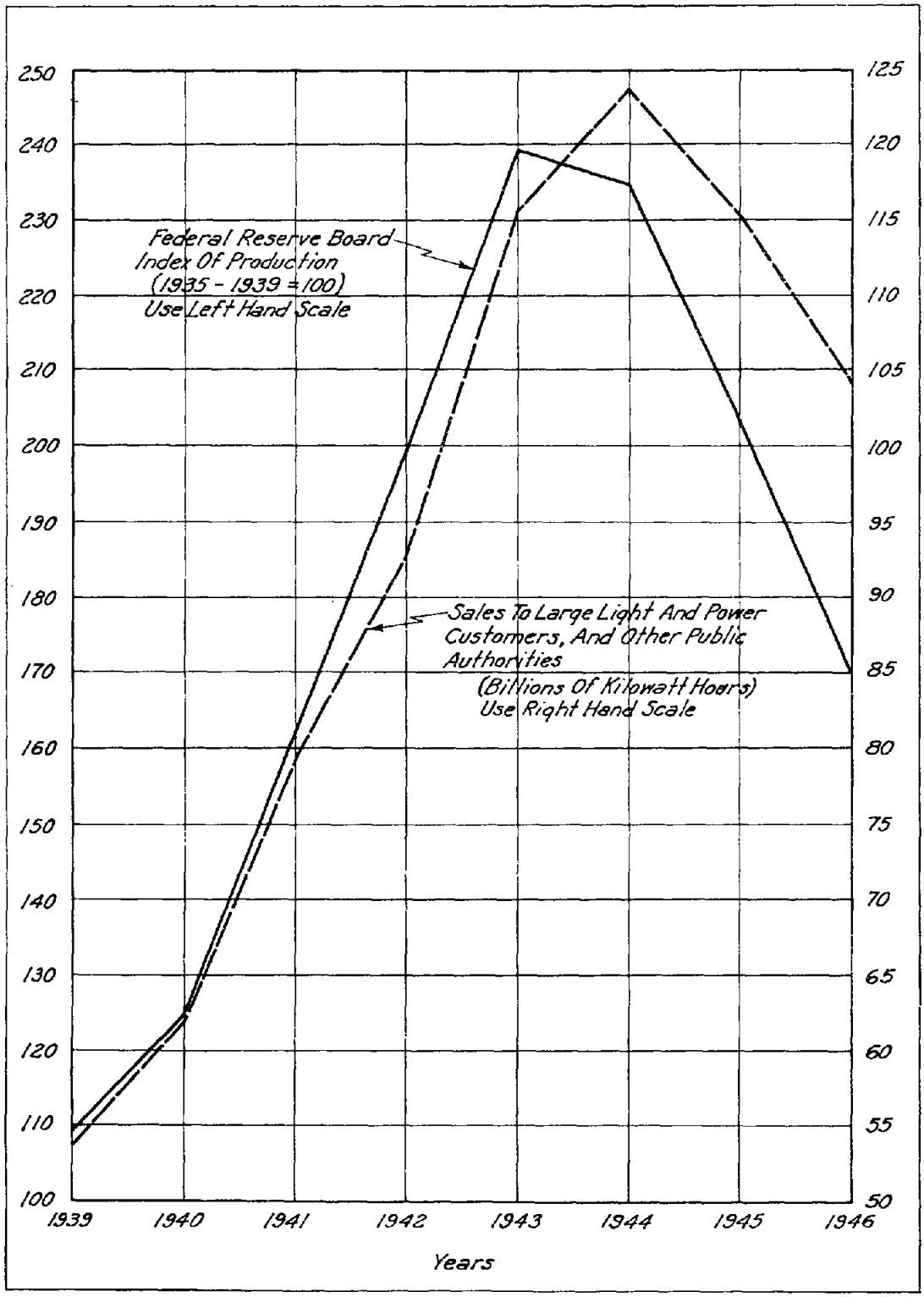

250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
Federal Reserve Board
Index Of Production
(1935 - 1939 = 100)
Use Left Hand Scale
Sales To Large Light And Power
Customers, And Other Public
Authorities
(Billions Of Kilowatt Hours)
Use Right Hand Scale
1939
1940
1941
1942
1943
1944
1945
1946
Years

CHART I

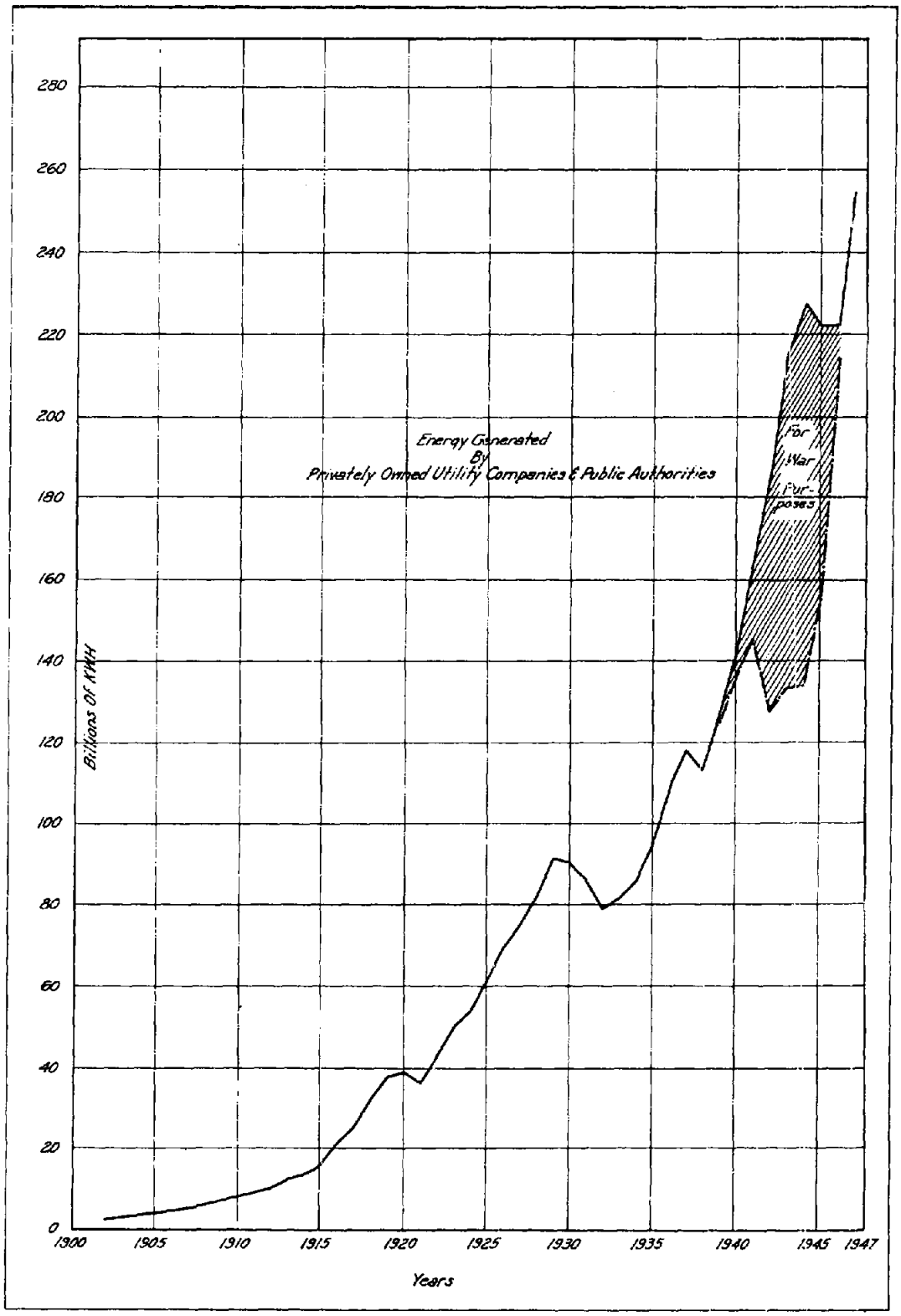
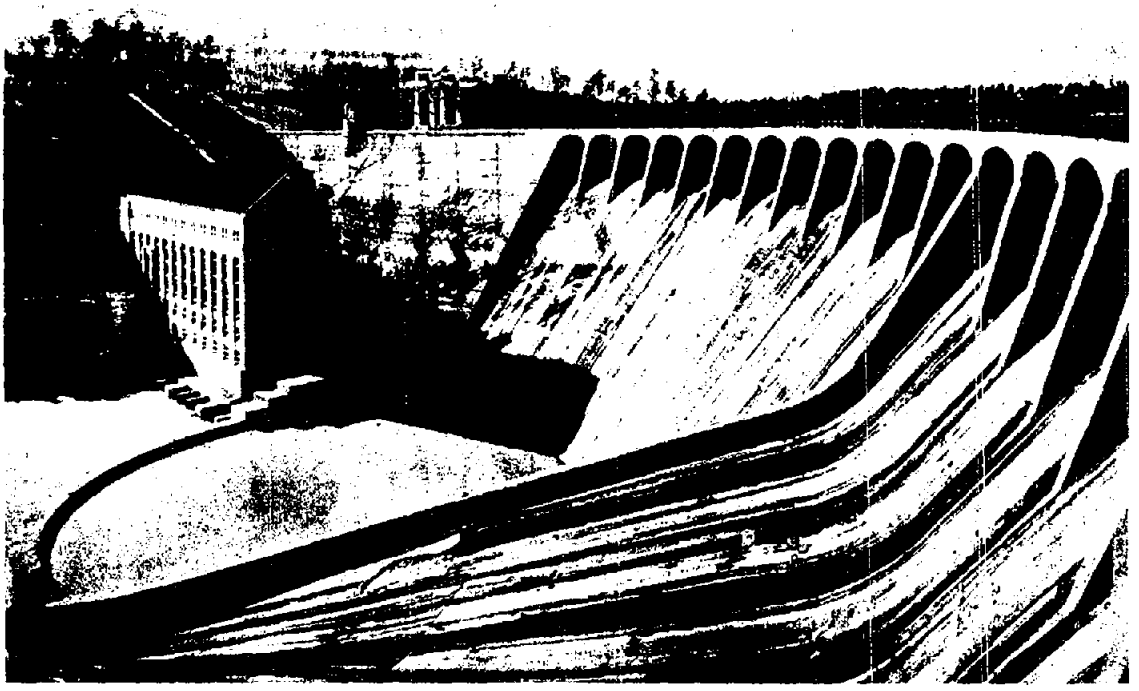

280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
Billions Of KWH
Energy Generated
By
Privately Owned Utility Companies & Public Authorities
For War Purposes
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1947
Years

CHART J

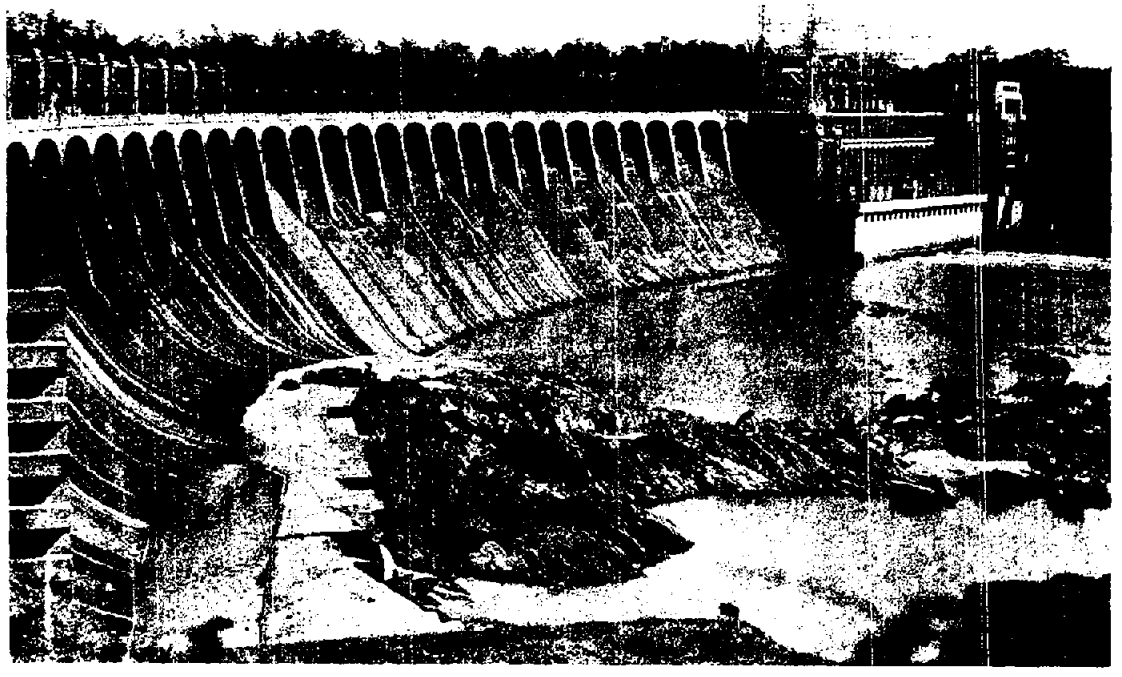
COMPARISON OF UTILIZATION OF GENERATING EQUIPMENT
ALL UTILITY COMPANIES EAST OF MISSISSIPPI RIVER
A. SIX FULLY INTEGRATED SYSTEMS CARRYING 40 PERCENT OF THE LOAD
B. APPROXIMATELY 90 NON-INTEGRATED COMPANIES CARRYING 60 % OF THE LOAD

	Dependable Capacity Kilowatts	Required Reserves Kilowatts	Per Cent Reserves	Energy Thousands Of Kilowatt Hours	Average Annual Load Factor	Hours Use Of Capacity Annually	Use Factor Of Equipment
1940 OPERATIONS (PRIOR TO WORLD WAR II)							
A. SIX SYSTEMS	7,861,799	788,110	10.02	37,000,523	60.14 %	4557	51.88 %
B. NINETY COMPANIES	14,502,870	2,009,483	13.86	55,274,789	52.09 %	3669	41.77 %
SAVING A over B							24.20 %
1943 OPERATIONS (DURING WORLD WAR II)							
A. SIX SYSTEMS	9,544,064	798,623	8.37	54,904,367	69.69 %	5647	64.46%
B. NINETY COMPANIES	16,904,744	1,813,097	10.73	80,252,251	61.15 %	4574	52.21 %
SAVING A over B							23.46 %

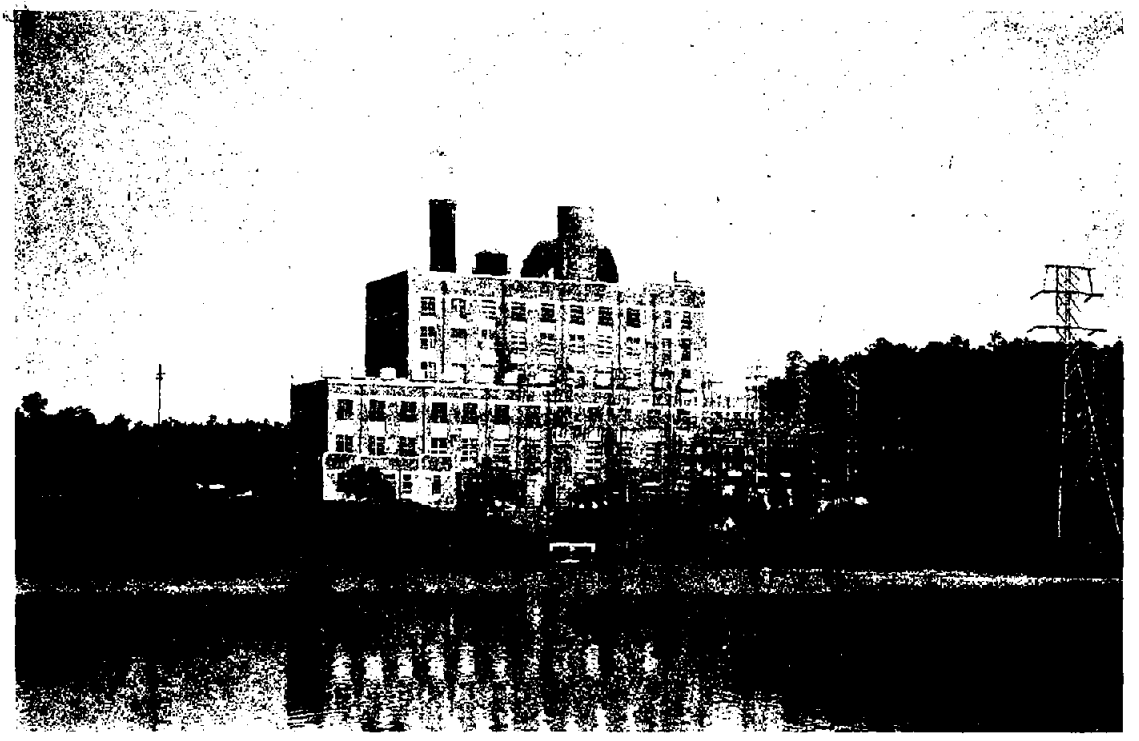
RESTRICTED



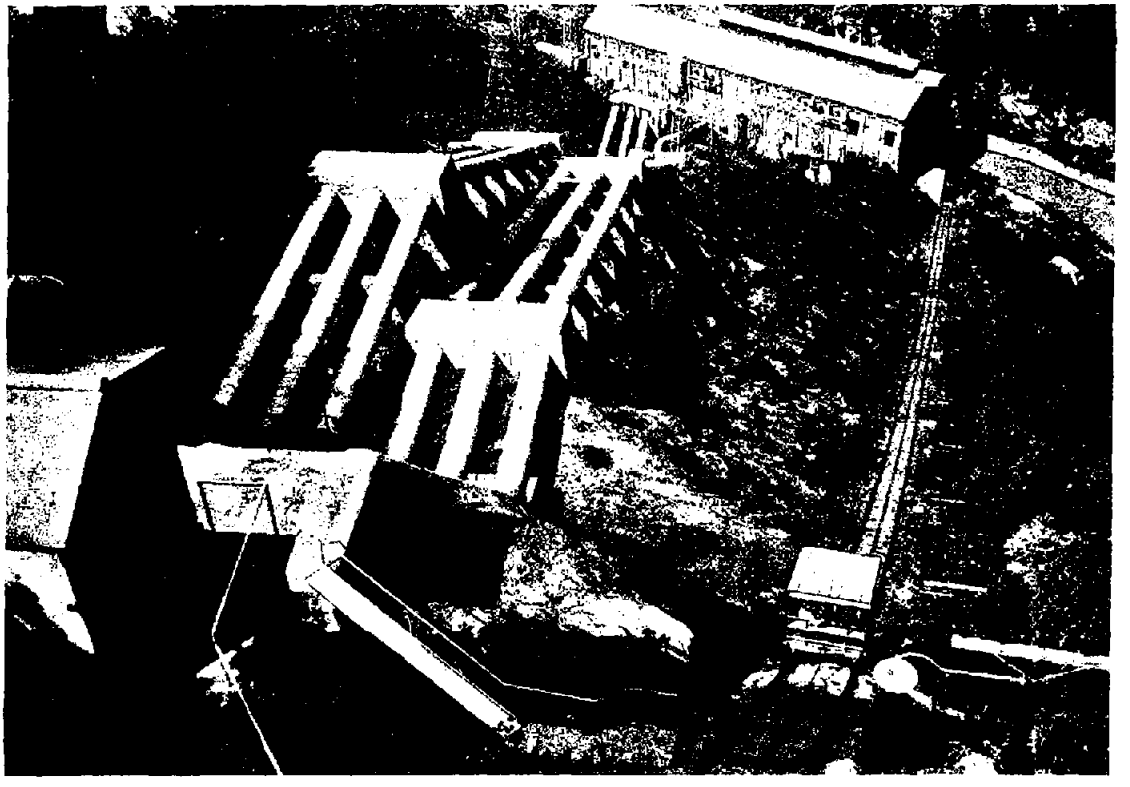
Martin Dam — Alabama Power Company



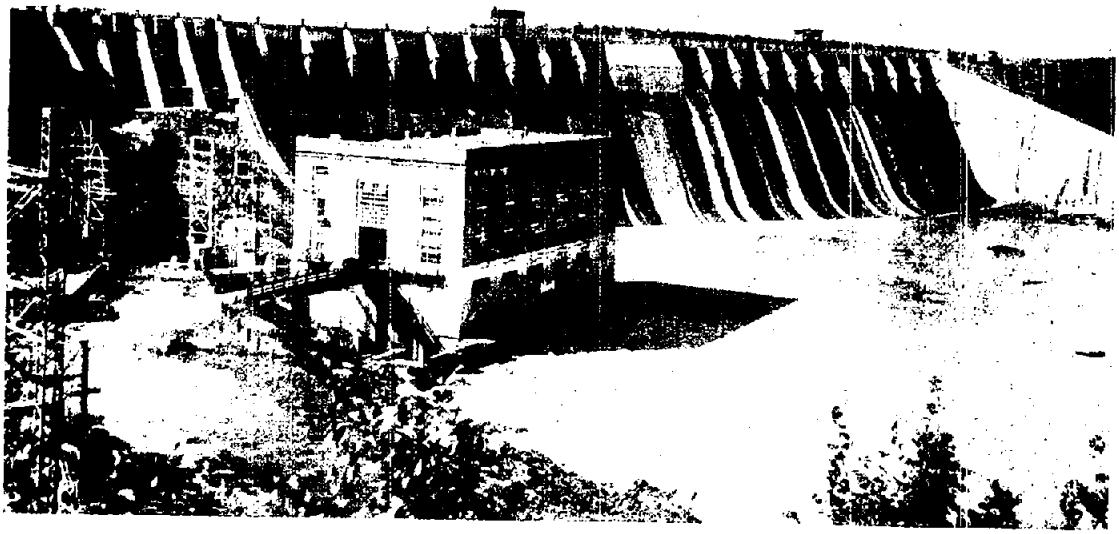
Jordan Dam — Alabama Power Company



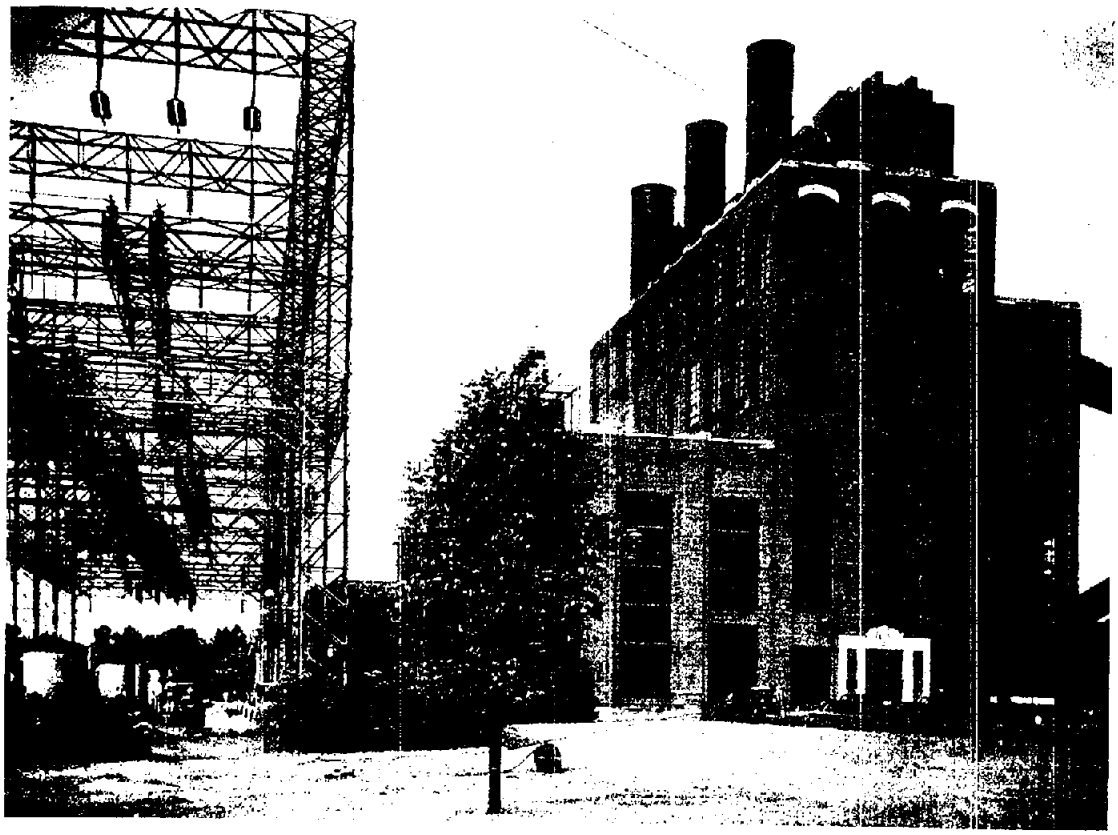
Gorgas No. 2 Steam Plant – Alabama Power Company



Tallulah Falls Plant — Georgia Power Company



Bartlett's Ferry Dam — Georgia Power Company



Plant Atkinson — Georgia Power Company

Appendix A.

STATISTICS OF THE ELECTRIC UTILITY INDUSTRY - PRIVATELY-OWNED UTILITIES AND PUBLIC AGENCIES

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Billions of Kilowatt Hours						Millions of Kilowatts	
	Total Energy Generated		Sales To Large Light & Power Customers	Sales To Other Public Authorities	Total of Columns 3 & 4	Total Sales To All Customers	Installed Capacity @ December 31.	
1902		2.5					1.2	
1907		5.9					2.7	
1912		11.6					5.2	
1913		12.5						
1914		14.4						
1915		16.2						
1916		21.2						
1917		25.4					9.0	
1918		33.2						
1919		38.9						
1920	39.4						12.7	
1921	37.2						13.5	
1922	43.6	40.3					14.2	14.3
1923	51.2						15.6	
1924	54.7						17.7	
1925	61.5						21.5	
1926	69.4		32.0				23.4	
1927	75.4		34.5				25.1	
1928	82.6		37.7				27.8	
1929	92.2		43.0				29.8	
1930	91.1		40.1				32.4	
1931	87.4		36.9				33.7	
1932	79.4		31.0				34.4	
1933	81.7		33.9				34.6	
1934	87.3		36.9				34.1	
1935	95.3		40.9				34.4	
1936	109.3		48.7				35.1	
1937	118.9		51.4				35.6	
1938	113.8		43.1				37.5	
1939	127.6		51.1	2.5	53.6	105.8	38.9	
1940	141.8		59.8	2.7	62.3	118.6	39.9	
1941	164.8		76.1	3.1	79.2	140.1	42.4	
1942	186.0		88.4	4.2	92.6	159.4	45.1	
1943	217.8		106.7	9.1	115.8	185.9	48.0	
1944	228.2		115.2	8.5	123.7	198.2	49.2	
1945	222.5		107.5	7.6	115.1	193.6	50.1	
1946	223.2		98.9	5.9	104.8	190.6	50.3	
1947	255.7		113.5				52.2	

(See explanatory notes on page following)

NOTES ON APPENDIX A

Note 1. Column 1 shows generation (in billions of kilowatt hours) of all plants contributing to the public power supply, for the period 1920-1947, inclusive, as reported in the Edison Electric Institute Statistical Bulletin for 1947, page 19.

Note 2. Column 2 shows total production of electric energy in the United States (in billions of kilowatt hours) as reported by the Federal Power Commission in "Electric Power Statistics 1920-1940," Appendix, page 4 for the years 1902-1919, inclusive; and from "Central Electric Light & Power Stations--1922" (Bureau of Census), page 8, for 1902, 1907, 1912, 1917, and 1922.

Note 3. Column 3 shows for the years 1928-1947, inclusive, (in billions of kilowatt hours) the sales to large light and power customers of the private companies and public agencies as reported by the Edison Electric Institute, page 26 of its 1947 Statisticul Bulletin; and similar information for the years 1926-1927, as reported in the Edison Electric Institute Statistical Bulletin for 1945, page 24.

Note 4. Column 4 shows for the years 1939-1946, inclusive, (the war period) the sales of the entire electric light and power industry, (both private companies and public agencies) to "Other Public Authorities," (in billions of kilowatt hours) as reported in the Edison Electric Institute Statistical Bulletin for 1947, page 27.

Note 5. Column 5 shows the total of columns 3 and 4.

Note 6. Column 6 shows the total sales of the entire industry, (both public agencies and private companies) (in billions of kilowatt hours), as reported by the Edison Electric Institute in its Statistical Bulletin for 1947, page 26.

Note 7. Column 7 shows the installed capacity at the end of each year (in millions of kilowatts) from 1920 through 1947, of all plants contributing to the public supply, as reported in the Edison Electric Institute Statistical Bulletin for 1947, page 16.

Note 8. Column 8 shows the installed capacity (in millions of kilowatts) at the year end, of all plants, commercial and municipal, as reported in "Central Electric Light & Power Stations--1922" (U.S. Bureau of Census) for the years 1902, 1907, 1912, 1917, and 1922, page 8.

1922

Appendix B.

STATISTICS OF THE PRIVATELY OWNED ELECTRIC UTILITY COMPANIES

	Installed Generating Capacity--Millions of Kilowatts
1902	1.1
1907	2.5
1912	4.8
1917	8.4
1920	12.0
1921	12.8
1922	13.4
1923	14.8
1924	16.7
1925	20.0
1926	21.8
1927	23.4
1928	26.0
1929	28.0
1930	30.3
1931	31.5
1932	32.0
1933	32.2
1934	31.5
1935	31.8
1936	31.8
1937	32.0
1938	33.2
1939	33.9
1940	34.4
1941	36.0
1942	37.4
1943	39.1
1944	39.7
1945	40.3
1946	40.3
1947	41.9

Installed capacity (in millions of kilowatts) owned by privately owned utility companies at the year end, as reported in the Edison Electric Institute Statistical Bulletin for 1947, page 16, for the years 1920-1947, inclusive, and as reported in "Central Electric Light & Power Stations--1922" (U.S. Department of Commerce, Bureau of the Census) page 9, for the years 1902, 1907, 1912, 1917, and 1922.

Appendix C

GENERAL ECONOMIC STATISTICS

	(1)	(2)	(3)	(4)	(5)	(6)
	Billions of Dollars					
	Gross National Product	Bank Deposits	Life Insurance in Force	F.R.B. Index of Production	Output per Man-hour (1923-1925 =100)	Output per Man-hour (1939=100)
1902		9.1	10.5			
1903		9.6	11.6			
1904		10.0	12.5			
1905		11.4	13.4			
1906		12.2	13.7			
1907		13.1	14.1			
1908		12.8	14.5			
1909	34.0	14.1	15.5		62.2	37.9
1910	36.7	15.3	16.4			
1911	36.8	15.9	16.0			
1912	38.5	17.0	19.2			
1913	40.0	17.5	20.5			
1914	38.5	18.5	21.6		71.7	43.7
1915	42.1	19.2	22.8			
1916	47.8	22.9	24.7			
1917	59.5	26.3	27.2			
1918	65.5	27.9	29.9			
1919	77.1	32.7	35.7	72	71.7	43.7
1920	86.2	37.4	42.3	75		
1921	70.3	34.8	46.0	58		
1922	72.5	37.1	50.3	73		
1923	84.3	40.0	56.6	88	94.0	57.4
1924	83.4	42.9	63.3	82	100.1	61.1
1925	90.0	46.7	71.7	90	106.2	64.8
1926	95.3	48.8	79.6	96	110.1	67.2
1927	93.5	51.1	87.0	95	113.4	69.2
1928	95.6	53.2	95.2	99	119.1	72.7
1929	103.8	51.5	103.1	110	123.8	75.5
1930	90.9	51.0	107.9	91	127.5	77.8
1931	75.9	49.2	108.9	75	132.6	80.9
1932	58.3	40.8	103.2	58	128.0	78.1
1933	55.8	36.9	98.0	69	135.5	82.7
1934	64.9	41.3	98.5	75	140.4	85.7
1935	72.2	45.1	100.7	87	148.8	90.8
1936	82.5	49.8	104.7	103	150.3	91.7
1937	90.2	51.8	109.6	113	147.8	90.2
1938	84.7	51.1	111.1	89	150.7	91.9
1939	90.4	54.9	114.0	109	163.9	100.0
1940	100.5	60.3	117.8	125	172.8	105.4
1941	125.3	65.9	124.7	162	177	108
1942	159.8	71.0	130.3	199	182	111
1943	192.6	94.3	140.3	239	183	112
1944	212.2	115.3	149.1	235	187	114
1945	213.4	139.7	155.7	203	196	120
1946	209.3	144.7		170		
1947	231.6			187		

Note 1: Column 1 shows the gross national product (in billions of dollars) by years for the period 1909-1947, inclusive, as reported by the "Handbook of Basic Economic Statistics", Volume II, No. 10, October 1948, Pages 4-5.

> Gross National Product or Expenditure is the market value of the output of goods and services produced by the Nation's economy, before deduction of depreciation charges and other allowances for business and institutional consumption of durable capital goods. Other business products used up by business in the accounting period are excluded. The Nation's economy in this context refers to the labor and property supplied by residents of the Nation.

Note 2: Column 2 shows total deposits of all banks at June 30 of each year from 1929 through 1946 (in billions of dollars) as reported in the "Statistical Abstract of the United States" - 1947, Page 398; for 1921-1928 inclusive, from "Statistical Abstract of the United States" for 1930, p. 262; and for 1902-1920, inclusive, from "Statistical Abstract of the United States" for 1920, p.768.

Note 3: Column 3 shows total life insurance (in billions of dollars) in force at the year end, 1915-1945, inclusive, as reported in the "Statistical Abstract of the United States" - 1947, Page 448; and for 1902-1914, inclusive, from "Statistical Abstract of the United States" for 1920, p. 655.

Note 4: Column 4 shows the Federal Reserve Board Index of Industrial Production, as reported by "The Handbook of Basic Economic Statistics," Vol.II, No. 10, October 1948, page 80. The Federal Reserve Board Index of industrial production is described as follows:

> The index is an overall measure of changes in the physical volume of production of manufactures and minerals; it does not cover other types of goods and services and it does not reflect changes in prices. As now revised the index is derived from about 100 individual series, 20 more than heretofore. These 100 series are distributed among 16 groups of manufacturing and two groups of mining industries.
>
> Some of the individual series are based on statistics of monthly output or materials or finished products while other series relate to consumption or shipments of materials, machinery hours active, or manhours worked. Statistics of manhours worked in a number of lines are adjusted to allow for broad changes in output per manhour, as measured by other data not suitable for use in a monthly production index. Many of the other series are also adjusted to more accurate physical volume figures not available monthly, such as Census statistics. All principal groups of

(Continued)

industries in manufacturing and in mining are directly represented in the index at some degree in the production process.

Peacetime classifications and titles are retained in this revision but for a number of series, especially machinery and transportation equipment, the titles are no longer accurately descriptive of the output of the plants covered.

In constructing the index, the relatives for the individual series are combined into composite index numbers for industries, for groups of industries and for industrial production as a whole. In compiling the composite indexes the importance (weight) of the individual series was measured by the value added by manufacture and by the value of minerals.

Note 5. Column 5 shows output per man-hour (based upon 1923-1925 equals 100) for manufacturing for the years 1909-1940, inclusive, as reported on page 13 of the 1941 edition (Vol. 2) of the Handbook of Labor Statistics (Bureau of Labor Statistics, U. S. Department of Labor), and for the years 1941-1945, inclusive, from "Productivity and Progress," a report of the Conference Board, 16 May 1946, page 7 (by scaling).

"The production index used in computing man-hour output up to 1939 is the National Bureau of Economic Research index, constructed from the detailed data collected by the Bureau of the Census and published in a volume by Mr. Solomon Fabricant, The Output of Manufacturing Industries, 1899-1937. For the year 1940 the Federal Reserve Board index is linked to the National Bureau of Economic Research index."

Note 6. Column 6 shows the data of Column 5 adjusted to the basis of 1939 equals 100 percent.

DETERMINATION OF ENERGY SALES TO LARGE LIGHT & POWER CUSTOMERS PER MAN-HOUR WORKED IN ALL MANUFACTURING INDUSTRIES

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
					Energy Sales to Large Light & Power Customers		
	Millions of Manufacturing Workers	Average Weekly Hrs. of Work	Average Annual Hrs. of Work	Billions of Man-hours Worked in Manufacturing	Billions of Kwh	Kwh per Man-hour Worked in Mfg.	Kwh per Man-hour in Percent of 1939
1926	8.3	45.0	2,340	19.4	32.0	1.65	52.1
1927	8.2	45.0	2,340	19.2	34.5	1.80	56.8
1928	8.2	44.4	2,309	18.9	37.7	1.99	62.8
1929	8.7	44.2	2,298	20.0	43.0	2.15	67.8
1930	7.6	42.1	2,189	16.6	40.1	2.42	76.3
1931	6.4	40.5	2,106	13.5	36.9	2.73	86.1
1932	5.4	38.3	1,992	10.8	31.0	2.87	90.5
1933	6.0	38.1	1,981	11.9	33.9	2.85	89.9
1934	7.0	34.6	1,799	12.6	36.9	2.93	92.4
1935	7.5	36.6	1,903	14.3	40.9	2.86	90.2
1936	8.1	39.2	2,038	16.5	48.7	2.95	93.1
1937	8.9	38.6	2,007	17.9	51.4	2.87	90.5
1938	7.5	35.6	1,851	13.9	43.1	3.10	97.8
1939	8.2	37.7	1,960	16.1	51.1	3.17	100.0
1940	8.8	38.1	1,981	17.4	59.6	3.43	108.2
1941	10.8	40.6	2,111	22.8	76.1	3.34	105.4
1942	12.6	42.9	2,231	28.1	88.4	3.15	99.4
1943	14.6	44.9	2,335	34.1	106.7	3.13	98.7
1944	14.1	45.2	2,350	33.1	115.2	3.48	109.8
1945	12.4	43.4	2,257	28.0	107.5	3.84	121.1
1946	11.7	40.4	2,101	24.6	98.9	4.02	126.8
1947	12.9	40.3	2,096	27.0	113.5	4.20	132.5

Note 1: Column 1 shows the estimated number of production workers (in millions) for all manufacturing industries as reported on page 34 of the "Handbook of Basic Economic Statistics," October 1948, Vol. II, No. 10.

Note 2: Column 2 shows the average weekly hours worked by production workers of all manufacturing industries, as reported on page 34 of the "Handbook of Basic Economic Statistics," October 1948, Vol. II, No. 10.

Note 3: Column 3 shows the average annual hours worked by production workers of all manufacturing industries. The figures were obtained by multiplying the figures in Column 2 by 52.

Note 4: Column 4 shows the total manhours worked (in billions) by production workers in all manufacturing industries. The figures were obtained by multiplying the number of workers shown in Col. 1 by the average annual hours worked, shown in Column 3.

Note 5: Column 5 shows for the years 1928-1947, inclusive, (in billions of kilowatt hours) the sales to large light and power customers of the private companies and public agencies, as reported by the Edison Electric Institute at Page 26 of its 1947 Statistical Bulletin; and similar information for the years 1926-1927, as reported at Page 24 of the Edison Electric Statistical Bulletin for 1945.

Note 6: Column 6 shows the energy sales to large light and power customers of the private companies and public agencies expressed in kilowatt hours per manhour of work in all manufacturing industries. The figures were obtained by dividing the sales shown in Column 5 by the manhours shown in Column 4, and as tabulated Column 6 is expressed in kilowatt hours per manhour.

Note 7: Column 7 shows sales to large light and power customers per manhour worked in the manufacturing industries, expressed in index numbers based upon 1939 = 100%. In other words, it shows the figures of Column 6 translated into percent of 1939.

Appendix E.

DETERMINATION OF WAR LOAD SERVED BY THE UTILITY INDUSTRY - 1939-1946

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
					Energy Sales - Billions of KWH						Generation-Billions of Kwh		
	F.R.B. Index of Production			War Component in Per Cent of Total	To Large Light and Power Customers	To Other Public Authorities	Total of Columns 5 & 6	For War Purposes	Total to All Customers	War Sales in Per Cent of Total Sales	Total	War	Civilian
	Total	War	Civilian										
1939	109	1	108	1	51.1	2.5	53.6	1	105.8	1	127.6	1.3	126.3
1940	125	6	119	5	59.6	2.7	62.3	3	118.6	3	141.8	4.3	137.5
1941	162	32	130	20	76.1	3.1	79.2	16	140.1	11	164.8	18.1	146.7
1942	199	107	92	54	88.4	4.2	92.6	50	159.4	31	186.0	57.7	128.3
1943	259	159	80	67	106.7	9.1	115.8	78	185.9	42	217.8	91.5	126.3
1944	295	155	80	66	115.2	8.5	123.7	82	198.2	41	228.2	93.6	134.6
1945	203	100	103	49	107.5	7.6	115.1	56	193.6	29	222.5	64.6	157.9
1946	170	10	160	6	98.9	5.9	104.8	6	190.6	3	223.2	6.7	216.5

Note 1. Column 1 shows the Federal Reserve Board Index of Industrial Production as reported in "The Handbook of Basic Economic Statistics," Vol. II, No. 10, October 1948, page 80. The Federal Reserve Board Index of industrial production is described in part by the Board as follows:

> The index is an overall measure of changes in the physical volume of production of manufactures and minerals; it does not cover other types of goods and services and it does not reflect changes in prices. As now revised the index is derived from about 100 individual series, 20 more than heretofore. These 100 series are distributed among 16 groups of manufacturing and two groups of mining industries.
>
> Some of the individual series are based on statistics of monthly output of materials or finished products while other series relate to consumption or shipments of materials, machinery hours active, or manhours worked. Statistics of manhours worked in a number of lines are adjusted to allow for broad changes in output per manhour, as measured by other data not suitable for use in a monthly production index. Many of the other series are also adjusted to more accurate physical volume figures not available monthly, such as Census statistics. All principal groups of industries in manufacturing and in mining are directly represented in the index at some stage in the production process.
>
> Peacetime classifications and titles are retained in this revision but for a number of series, especially machinery and transportation equipment, the titles are no longer accurately descriptive of the output of the plants covered.
>
> In constructing the index, the relatives for the individual series are combined into composite index numbers for industries, for groups of industries and for industrial production as a whole. In compiling the composite indexes the importance (weight) of the individual series was measured by the value added by manufacture and by the value of minerals.

Notes 2-3. Columns 2 and 3 show a breakdown of the Federal Reserve Board Index shown in Column 1 between war and civilian production as reported in The Federal Reserve Bulletin for September 1945, at Page 852, supplemented by statistics obtained from the Board of Governors of the Federal Reserve System, Division of Research and Statistics July 1947.

Note 4. Column 4 shows the ratio of Column 2 to Column 1, expressed in per cent.

Note 5. Column 5 shows for the years 1939-1946, inclusive, (in billions of kilowatt hours) the sales to large light and power customers of the private companies and public agencies, as reported by the Edison Electric Institute at page 26 of its 1947 Statistical Bulletin.

Note 6. Column 6 shows for the years 1939-1946, inclusive, (the war period) the sales of the entire electric light and power industry, (both private companies and public agencies) to "other public authorities", (in billions of kilowatt hours) as reported in the Edison Electric Institute Statistical Bulletin for 1947, at page 27.

Note 7. Column 7 shows the total of Columns 5 and 6.

Note 8. Column 8 shows the product of Column 7 by Column 4.

Note 9. Column 9 shows the total sales of the entire industry (both public and private) in billions of kilowatt hours, as reported by the Edison Electric Institute in its Statistical Bulletin for 1947 at page 26.

Note 10. Column 10 shows the ratio of Column 8 to Column 9, expressed in per cent.

Note 11. Column 11 shows generation (in billions of kilowatt hours) of all plants contributing to the public power supply, for the period 1939-1946 inclusive, as reported in the Edison Electric Institute Statistical Bulletin for 1947, at page 19.

Note 12. Column 12 shows the product of Column 11 by Column 10.

Note 13. Column 13 shows the difference between Column 11 and Column 12.