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STATUS OF THE ELECTRIC UTILITY INDUSTRY
IN THE UNITED STATES OF AMERICA

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Introduction

This is a report on the status of the electric utility industry in the United States of America, with special reference to the investor-owned segment i. e., the electric utility companies which are financed in the free market without the aid of government funds.

The total electric utility industry in the USA serves about 59 million ultimate customers. About 79 percent of these customers are served by the investor-owned electric companies. Twenty-one percent are served by various governmentally financed power agencies and cooperatives. In addition there are certain industrial plants and other large consumers of electricity which generate their own power. These produce about 10.5 percent of all the electric energy generated in the USA.

There are about 400 investor-owned companies in the USA, and, although each power company is a separate entity, all companies work closely together in the endeavor to solve their problems in the most economic and efficient manner. One important means they have developed to facilitate that cooperation is the Edison Electric Institute.

The Edison Electric Institute is a national trade association, organized in 1933. It provides a forum where electric utility people meet to discuss developments in their business. As new devices and techniques are developed to improve electric service, they are made known to all electric companies through the committees of the Institute. At the present time, there are some 75 committees and groups which cover the many phases of the electric utility operation. About 2,000 of the nation's top electric utility men and women work together on these committees.

The Electric Industry in the USA in 1960

According to preliminary estimates, the nation's total electric utility industry generated more than 752 billion kilowatt-hours of electricity in 1960. About 77 percent of this total was produced by the investor-owned companies, and 23 percent was produced by governmentally financed agencies and cooperatives. Industrial producers generated another 87.5 billion kilowatt-hours, and some 4.5 billion kilowatt-hours were imported, making a total of approximately 845 billion kilowatt-hours of electric energy available for use.

The long-term growth rate in the use of electricity in the United States has been at an average rate of 7.15 percent per year compounded. This rate of increase is slightly more than double the average rate of increase of the Gross National Product. The growth of the electric utility industry in the United States since World War II has been at an average rate of 8.6 percent.

As in most countries, electricity was first made available in the USA in the more densely populated areas. With the growth in transmission technology, the small isolated plants were shut down in favor of the large central stations serving large numbers of cities and towns. Then the various power companies began interconnecting their transmission systems one with the other. This has led to the large interconnected power pools now covering most of the country. Today, electric service is available to practically all homes, farms, businesses and industries in the quantities that they desire. Approximately 51 percent of the farm customers are served by rural electric cooperatives, financed by the Rural Electrification Administration. Forty-three percent of the farm customers are served by the investor-owned companies. The rural electric cooperatives purchase approximately 38 percent of their energy from the investor-owned companies.

Evolution of the Interconnected System

Charts 1 and 2 illustrate how the power system in the USA has been developed. The Roman numerals on the maps indicate the regions prescribed by the Federal Power Commission, the regulatory body having to do with the flow of energy in interstate commerce. The bars in Chart 2 represent the demand, reserve and capability by regions.

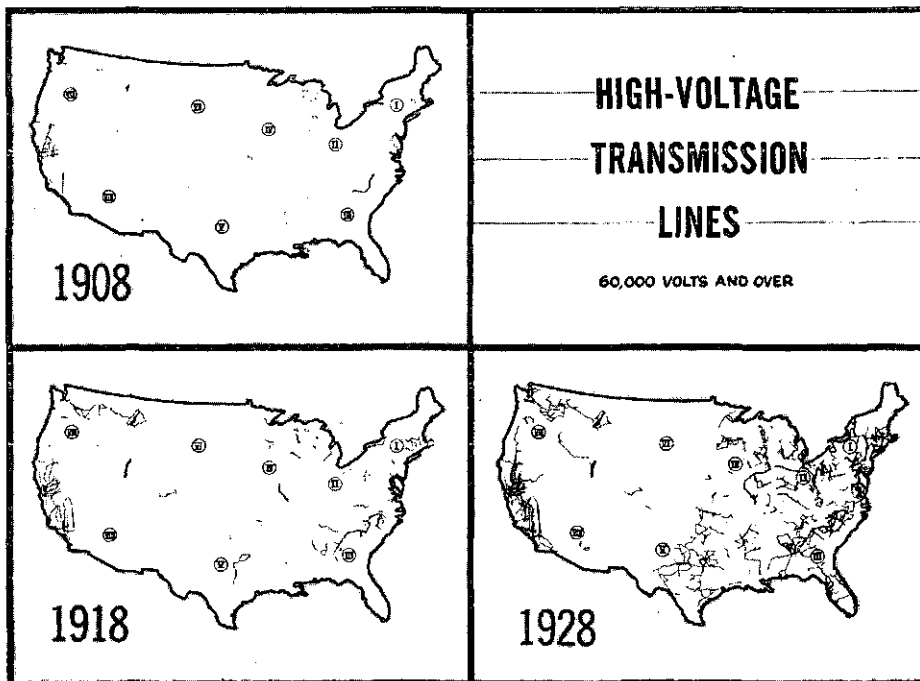


Chart 1

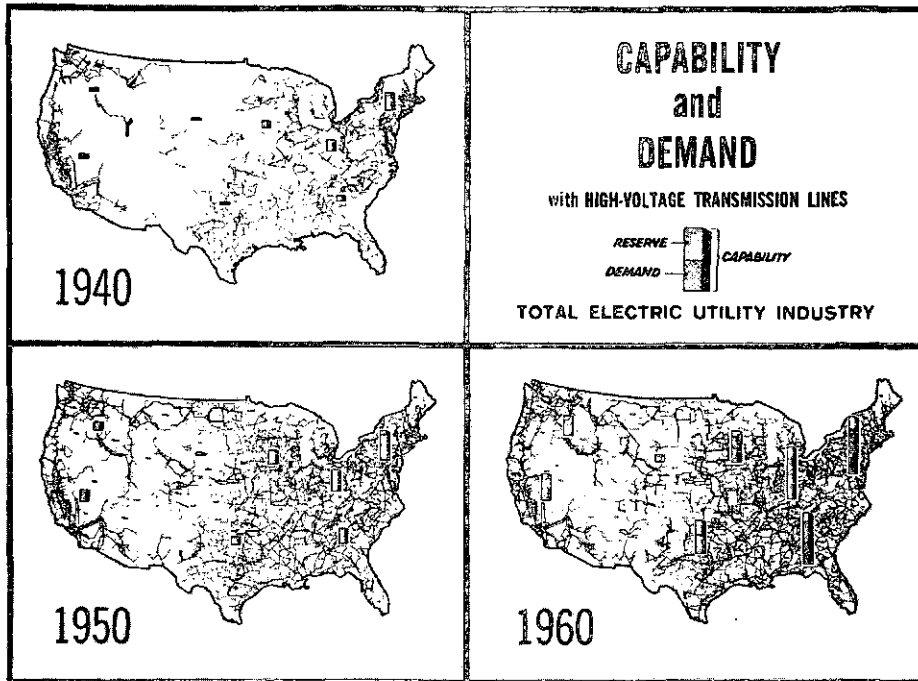


Chart 2

Today most of the companies have their transmission facilities connected one with the other. There are various degrees of power pooling. In some areas there are pools representing seven or eight or more companies. In such pools the companies build their power plants and transmission lines so as to bring about maximum economy for the whole system. In such pools there is a central load dispatcher bringing about the most economic loading of all generating plants in the pool every hour. In some cases electronic equipment operates the pool. Such a pool is illustrated in Chart 3.

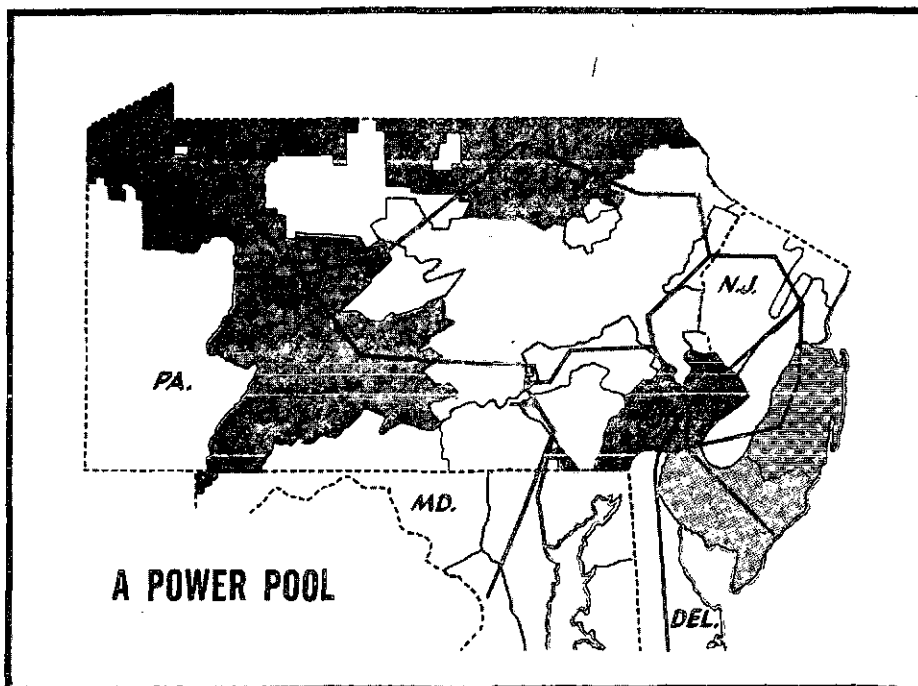


Chart 3

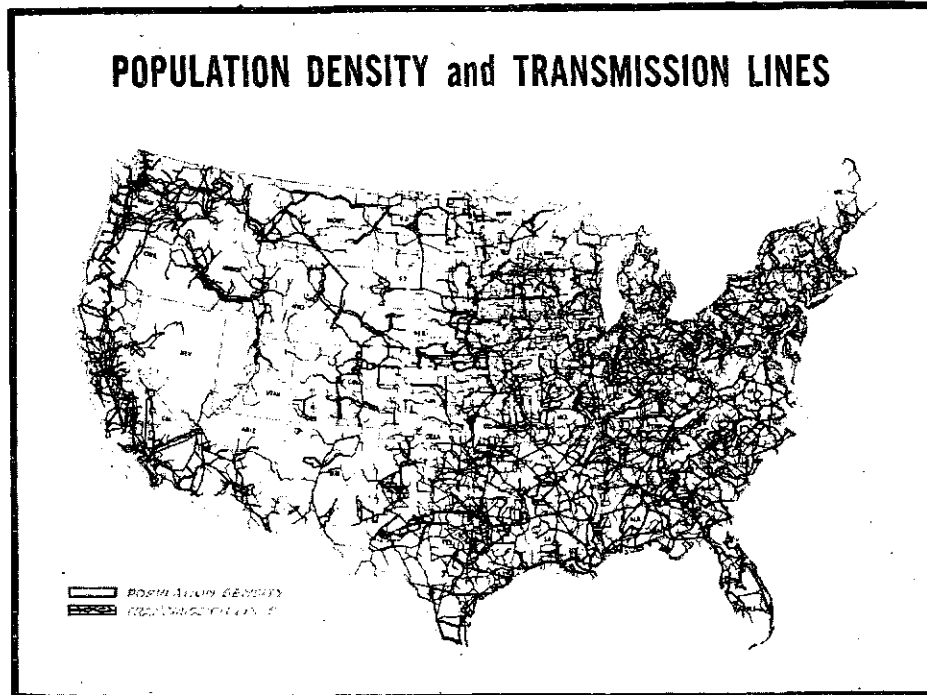


Chart 4

Chart 4 illustrates how transmission systems in the United States are heaviest in serving the more densely populated areas.

Although the demand has been doubling about every 10 years, generating capability has remained well above it. (Chart 5)

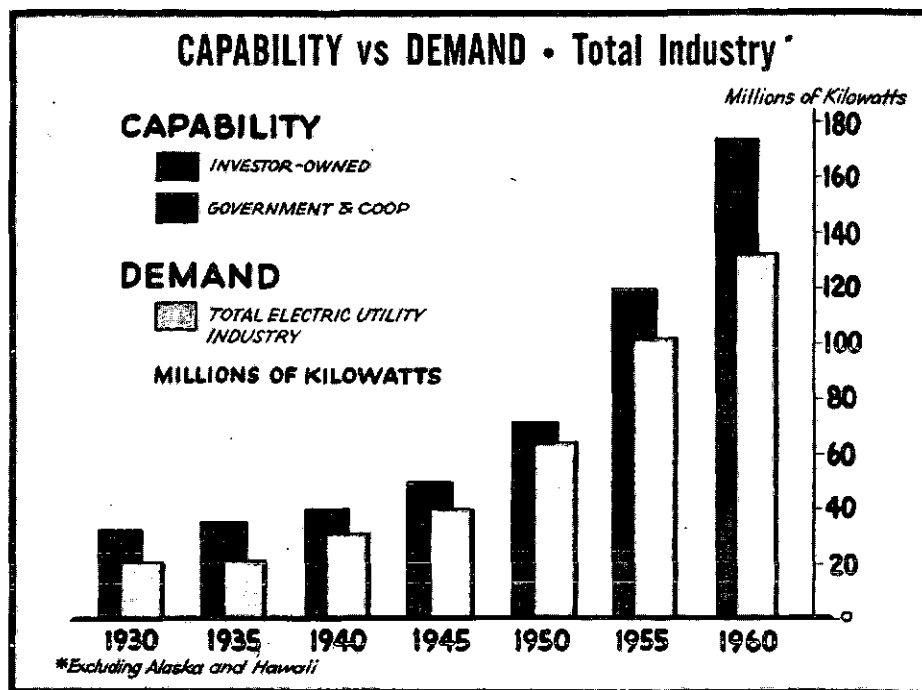


Chart 5

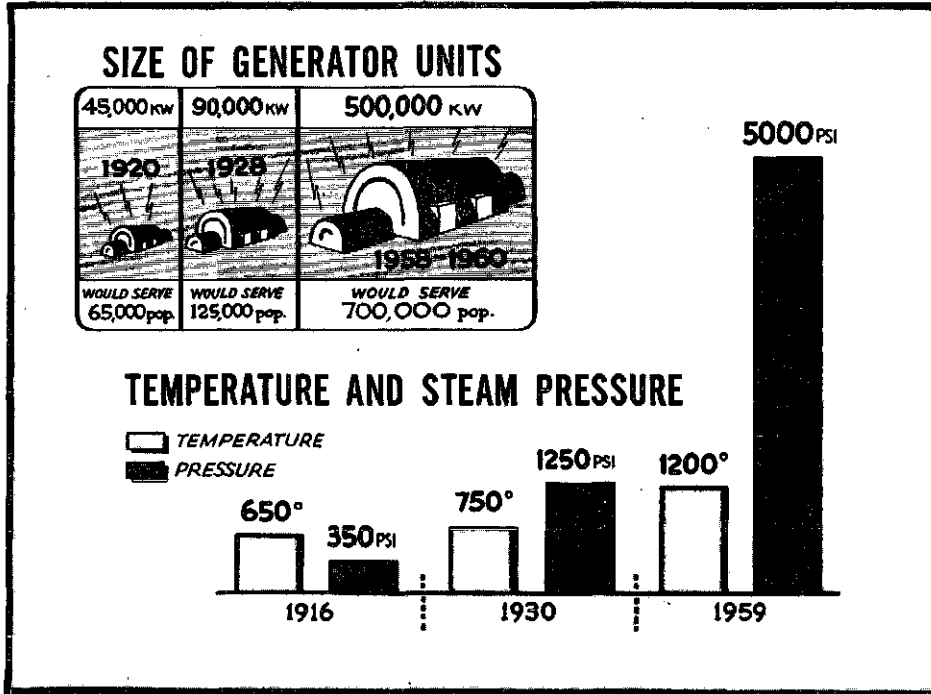


Chart 6

Utilization has been made of larger and larger generating units of higher and higher temperatures and pressures (Chart 6).

Transmission lines of higher and higher voltages have been developed and put into service (Chart 7). Today, research is being carried on at extra high voltages such as 750,000 volts.

The development of more and more pooling with larger and larger generating units has resulted in important economic benefits.

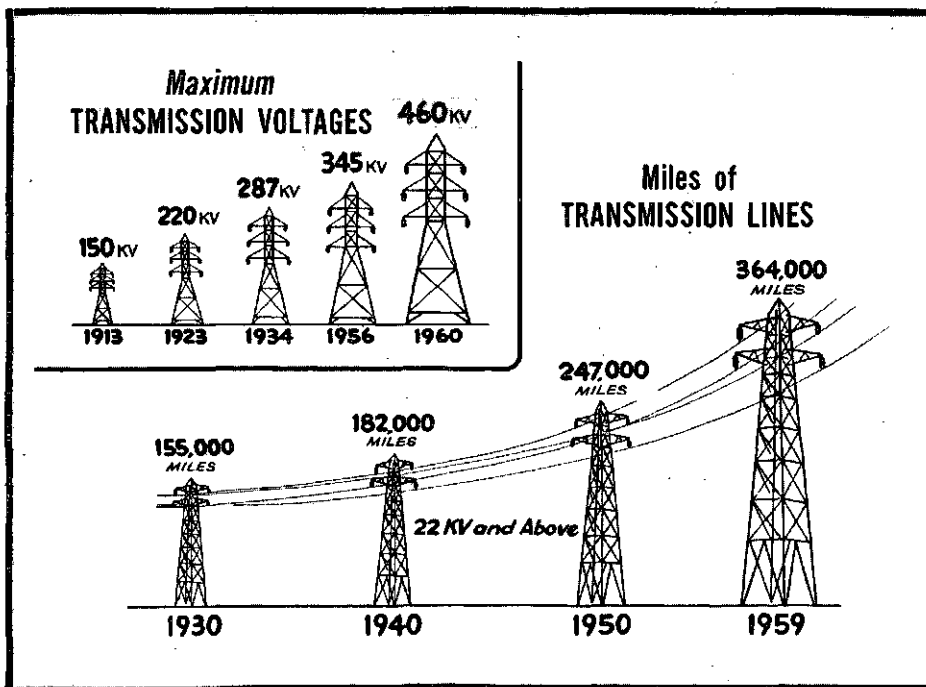


Chart 7

The annual construction expenditures per kilowatt of added capacity have remained about constant over the past 10 or 15 years, despite rising costs of material and labor. One index of construction costs is known as the Handy-Whitman Index. The relationship between the index and the cost per kilowatt is shown in Chart 8.

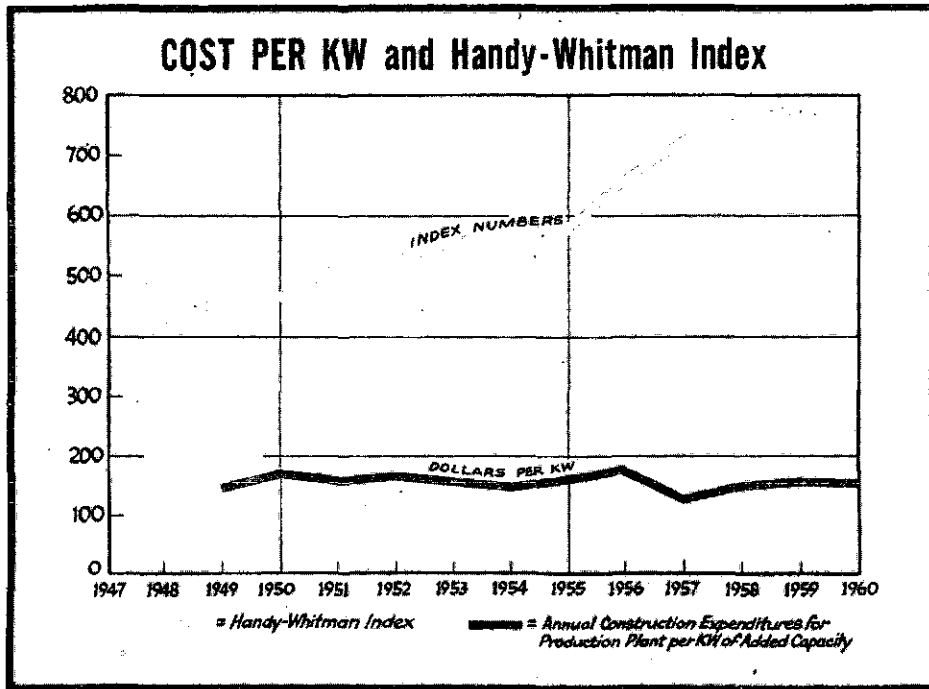


Chart 8

As might be expected, there has been an accompanying improvement in fuel economy as illustrated in Chart 9. Although coal, gas and oil are used as fuel, the chart here shows the fuel economy in coal equivalent.

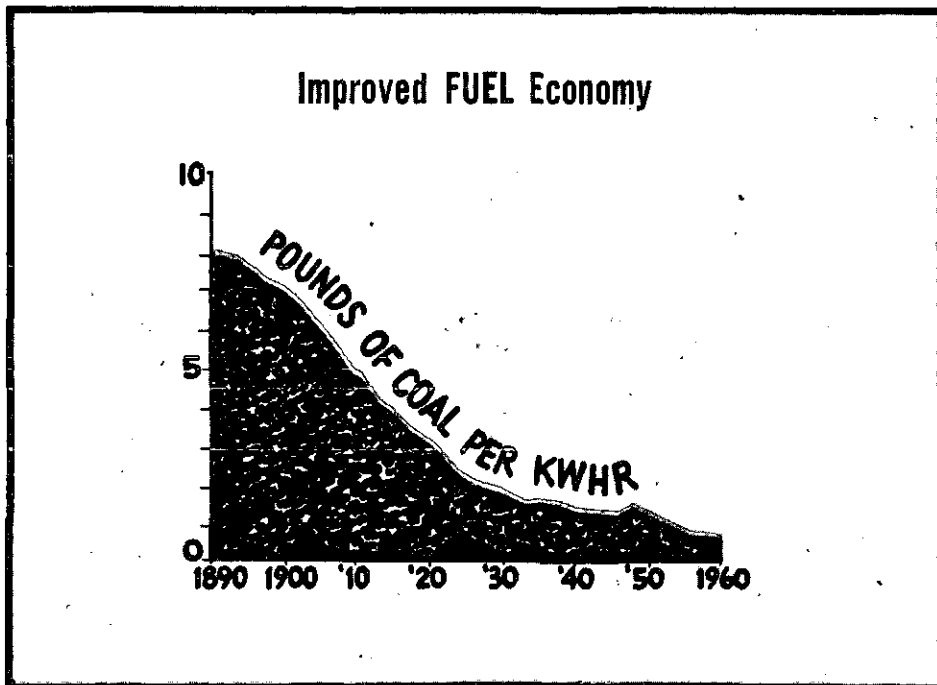


Chart 9

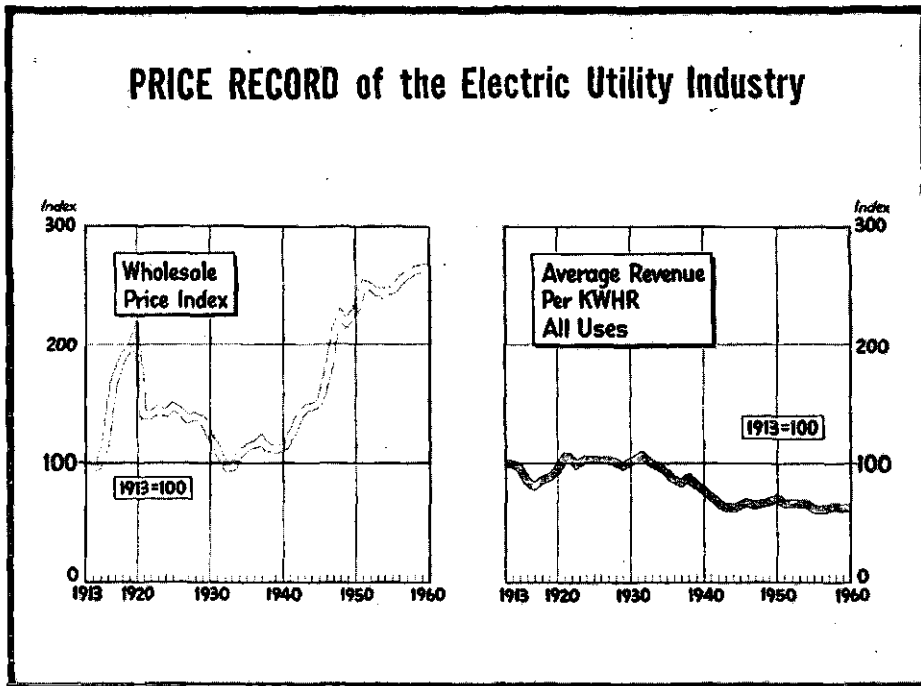


Chart 10

As in other countries, these over-all developments have made it possible to hold down and even lower the price of electricity to the customer, despite the general rise in the cost of living. This is illustrated in Chart 10 for the total price of electricity and in Chart 11 for the price of residential service.

Among the factors contributing to this record are improved efficiency of construction and operation, increased sales, increased diversity and load factor, and good government regulation.

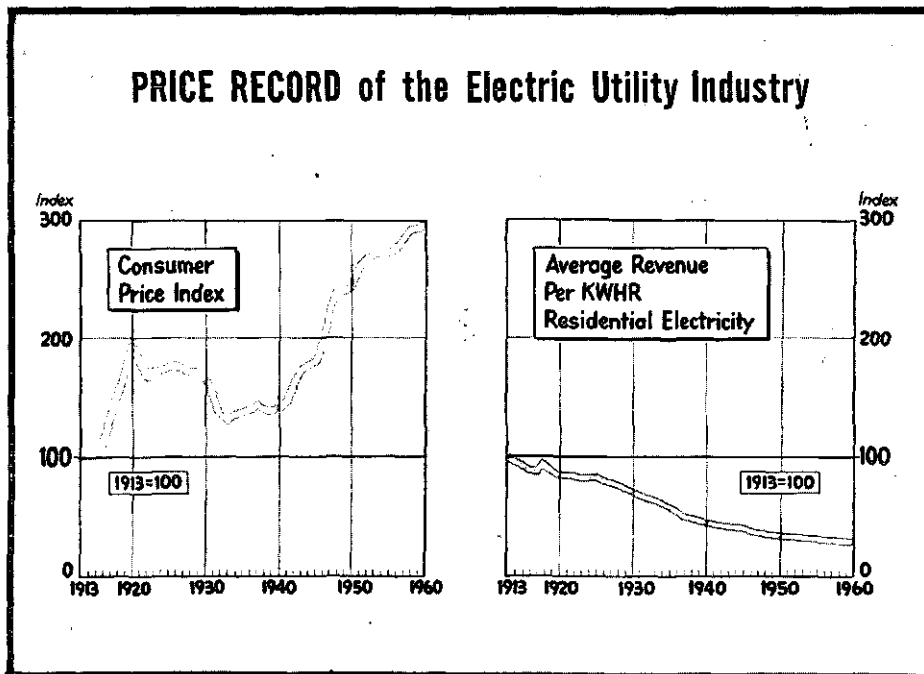


Chart 11

For the most part government power projects are financed from government funds either without interest or with interest rates below the free market cost of money. Also, government power projects are required to pay no Federal income taxes. There is little or no difference in the over-all efficiency of the operation of the investor-owned companies and government power projects. The lower rates of the government power projects simply reflect the differences in the cost of money and taxes. Naturally, these differences are made up by the general taxpayers.

Nuclear Power Development

As elsewhere, nuclear power in the USA has been going through the research and development stages. Beginning in World War II, nuclear developments were first carried on by the government. In 1954, non-government agencies such as investor-owned utilities and electrical manufacturers were allowed to enter into the field of nuclear power development. Now 129 investor-owned power companies are participating in 24 projects with eventual electrical capacity of about 2 million kilowatts. The nuclear power development program involves expenditures of about \$700 million on the part of the investor-owned companies. It now appears that economic and competitive nuclear power will become available in the high-cost fuel areas within the next five years or so. The Pacific Gas & Electric Company has just announced that it will construct a 325,000-kilowatt nuclear power plant 50 miles north of San Francisco, California. This facility, called Bedega Bay Atomic Park, will be a boiling water reactor plant. The company will build it without assistance from the government, and made its decision to build on the basis that nuclear power would be competitive in that area with power generated from fossil fuels.

The Importance of Sales

From the early years, and continuing through today, the power business in the USA has been characterized by its progressive selling. Vigorous sales programs are carried on continually by electric companies and their allies -- the apparatus and appliance manufacturers, distributors and dealers. It is believed that this has been an important factor in promoting the increased use of service with the accompanying increase in diversity and load factor. The result has been a higher and higher utilization of the investment, enabling the lowering of the price.

In 1915, about 95 percent of the electricity used in homes was for lighting. By 1959, although the average use for each residential customer was almost thirteen times greater than in 1915, 22 percent of the electricity used in homes was being used for lighting and 78 percent for other purposes.

The market for electricity is continually growing. New appliances are being developed on the average at the rate of 1-1/2 per year. That is to say, fifteen major appliances are used today that were not known ten years ago. It is anticipated that ten years from now there will be 15 additional new appliances.

Commercial establishments and industries now make wide use of this efficient and flexible form of energy.

This availability of an abundance of low-cost electricity has been one of the important factors contributing to the development of machine production in the USA. About 98 percent of the work done in our country is done by machines. Last year each factory worker had enough electricity available to him to be the equivalent in energy of 429 men helping him on his job. The more machinery we have in production, the more we can produce and the lower the cost of producing quantities of goods. This lowering of the price enables the worker to buy more and thus increase his real wages and standard of living. Experience shows that the number of jobs available increases with the increased use of machines.

Now that electricity is available to practically all of the farms, we are experiencing a gradual mechanization of our farming processes. This revolution is not unlike the industrial revolution which brought about the electrification and mechanization of industry. This mechanization of the farm will enable the production of more and more farm commodities at lower and lower prices.

By promoting the increased utilization of electricity in the home, on the farm, in business and in industry there results a balancing of the load with improved diversity and load factor. This diversification also results in greater stability of earnings, thus enabling the companies to attract money for new capital at the lowest possible rates of interest.

It requires constant effort to make sure that loads stay in balance. For example, air conditioning has been growing at a rapid rate, especially in the warm part of the country. Without the air conditioning load, the normal annual peak occurs in November and December. In the warmer part of the country, the air conditioning load, together with all cooling load, may be on the order of 1/4 to 1/3 of the total load. The companies are now vigorously promoting electric space heating. This tends to balance out the winter and summer loads and is helpful in holding down the price of electricity.

Through the Edison Electric Institute, the investor-owned companies are now carrying on a national sales promotion program called "Live Better Electrically." Advertisements are being run in national magazines telling the customers of all the modern conveniences now

available and of the advantages of electrical living. Electrical manufacturers tie into this program by promoting the Live Better Electrically theme.

In the USA the gas companies are very active in the promotion of gas for home, business and industrial use. There is strong competition between the gas companies and the electric companies, spurring each group on to higher efficiencies. The consumer benefits from this.

Possibly this competition among independent suppliers of commodities and services is one of the factors contributing to the high productive capacity and the accompanying high standard of living in the USA.

Research and Development

Much attention is being devoted by the electric industry in the USA to research and development. One measure of the scope and magnitude of these efforts is in terms of dollars being spent. Total electric industry research expenditures, including expenditures in the nuclear power field, are currently running in the neighborhood of 1/4 of a billion dollars annually. It has been estimated that in 1960 electric utility companies spent in excess of \$8 million for engineering and non-engineering research and an additional \$132 million on various phases of nuclear power research.

In addition, it has been estimated that manufacturers spend between \$100 million and \$125 million annually on research for electric utilities.

But the true dimensions of the industry's research cannot be fully reflected in the money spent. What will emerge out of the research today is difficult to predict accurately. At present, we can see only the broad outlines.

We are exploring nuclear fusion as a means of generating electricity. Much attention is being devoted to the area of direct conversion. Ahead, there is a vision of raw energy, including nuclear energy, converted directly into electricity. Many paths are being explored in the attempt to reach this goal, including magnetohydrodynamics, thermoelectric and thermionic devices, and the fuel cell. Another important area of study is that of heat storage. This is of some consequence for both the generation and utilization of electricity. If some way could be developed to store heat over a period of time, we could supply energy for heating during off-peak hours and thus lower the price considerably. Improvement in load factor is still one of the principal considerations which will enable us to keep the price low and to lower it further.

Today, electric companies are experimenting with the use of radar to warn of approaching ice and thunderstorms. They are studying the behavior of lightning. They are learning how to slow down the growth of trees, without impairing their health or appearance, in order to lessen the cost of the pruning needed to keep trees from growing into power lines.

Regulation of Utilities

In the USA, as in most parts of the world, economic considerations have resulted in the "sole supplier" concept in furnishing utility service. The primary reason is because of the high investment of some \$4.50 in plant and equipment for each \$1 of annual revenue. This compares to some 47¢ of investment per dollar of annual revenue in the ordinary manufacturing business. Duplication of the power system would result in the duplication of the high investment without increasing the available revenue.

In the USA competition and the laws of supply and demand are usually relied upon to regulate the prices of goods and services and to keep them reasonable. When there is a sole supplier of a commodity or service, government regulation is used as the means of looking after the interests of the consumers and the investors. Most states have a state regulatory body. It is their responsibility to assure adequate service at a reasonable price without undue discrimination. Matters pertaining to the flow of energy in wholesale quantities across state lines are under the jurisdiction of the Federal Power Commission. The Securities and Exchange Commission has regulatory powers concerning the issuance of securities.

The primary concern of the regulatory body is to insure a fair return and no more than a fair return on the fair value of the property used in furnishing the service. Thus the rates are fixed or approved by the regulatory body.

The regulatory body cannot and does not guarantee that the investors will always have a fair return. There is still risk in the business. However, regulatory bodies realize that the large amounts of capital required to build the power facilities are raised in the free market. The millions of Americans who have saved some money are free to invest it or not invest it in a business enterprise, and there are many businesses from which to choose. The earnings on the utility property must be sufficient to attract the new capital required to build facilities to serve the growing demands of customers.

The process has worked well. An abundant electricity supply is broadly available with ample reserves. Service is good. The average price has been declining in spite of the increased cost of living. Return on the investment is on the order of 5 to 6 percent.

Financing the Investor-owned Companies

Chart 12 shows the investment in the electric plant of the investor-owned companies.

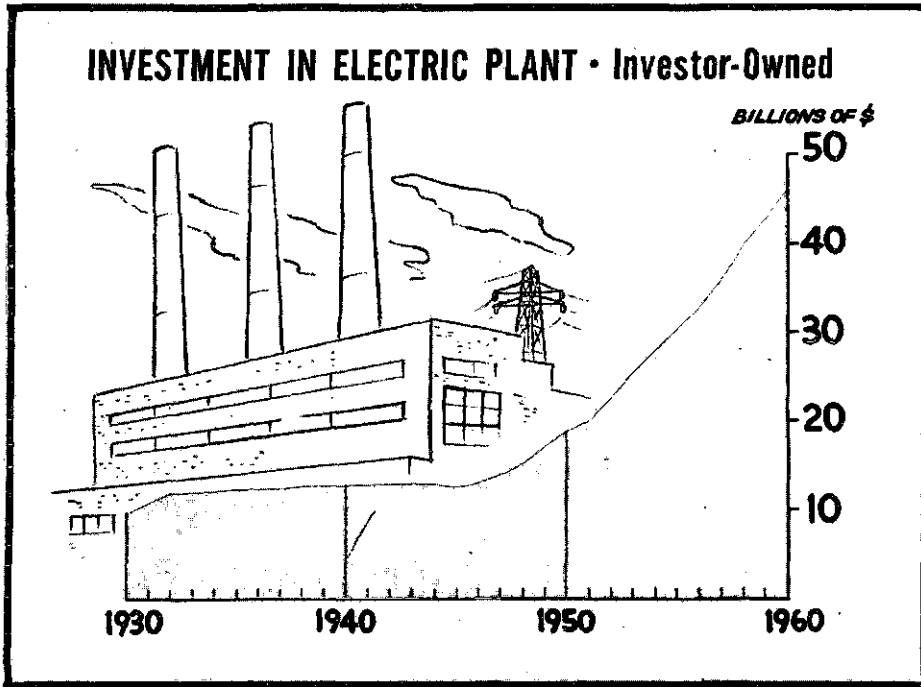


Chart 12

This investment is compared with the investment of other major industries in the US in Chart 13. In this chart the net plant investment is used. This represents total assets less reserves, investments in government obligations and other securities. The capital invested in the investor-owned electric utility industry is 12 percent of the total capital invested in all US business.

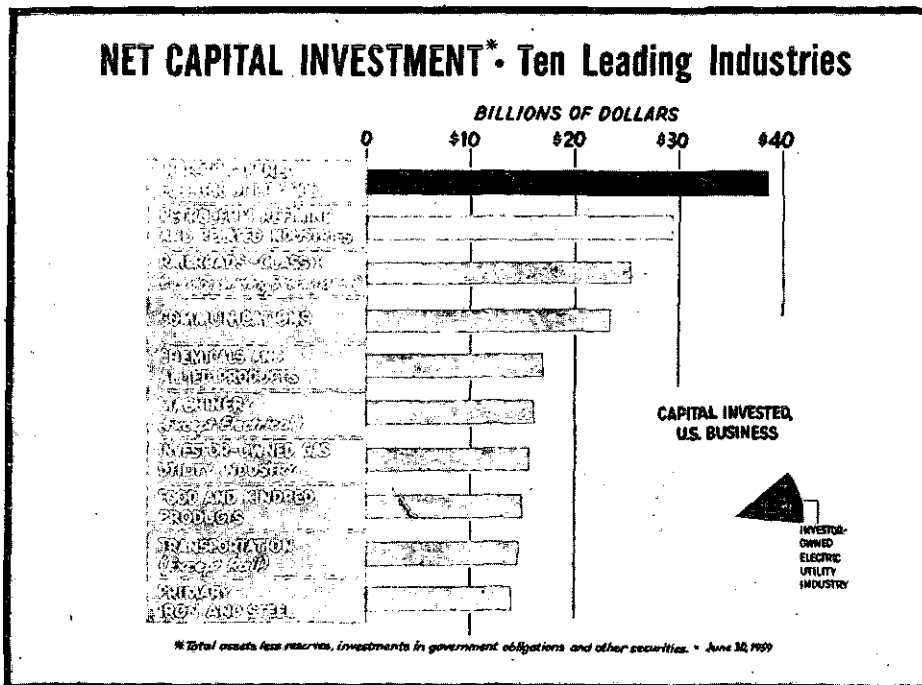


Chart 13

Expenditures for new plant and equipment have been at the rate of \$3.2 billion per year. Chart 14 shows how this compares with similar spending for new plant in other major industries in the US. Economists point out that capital expenditures for new plant constitute an important factor in creating jobs, purchasing power and well-being.

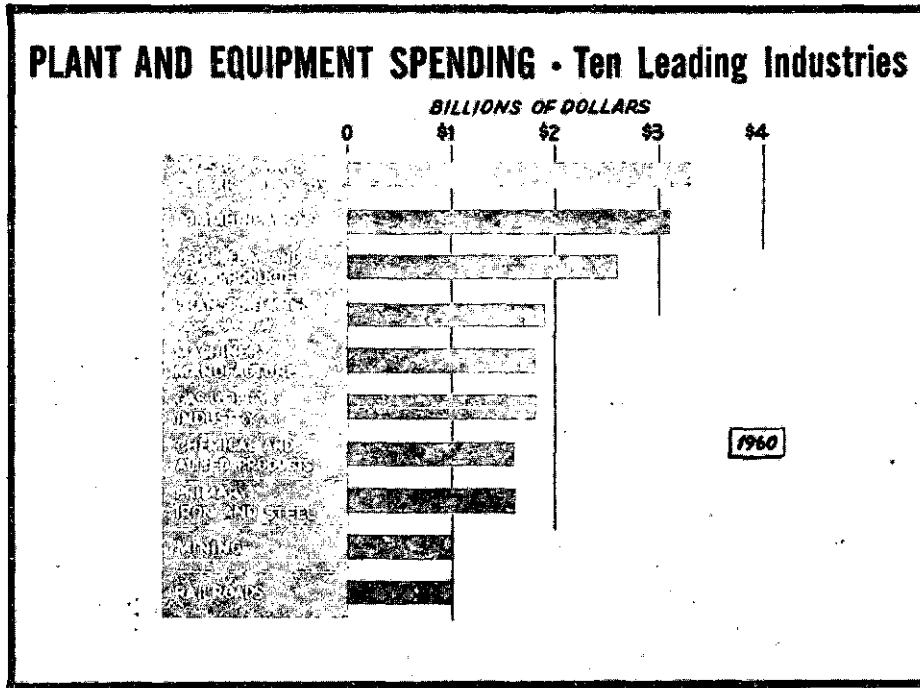


Chart 14

Plans for the Future

Chart 15 shows the record of electric energy generation by the total electric utility industry for 1930 through 1960. It also shows a forecast of generation to the year 2000.

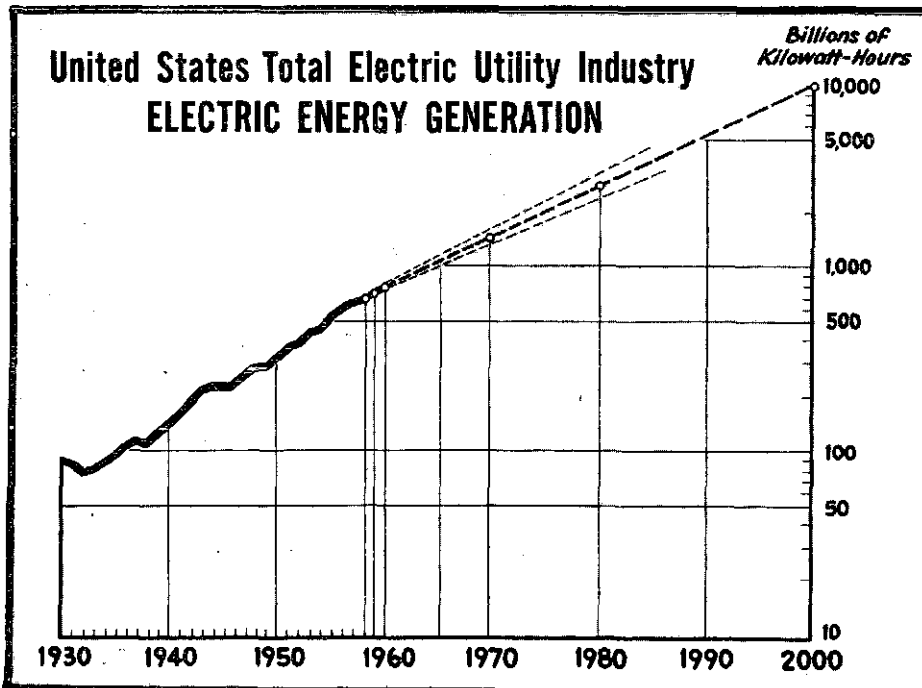


Chart 15

The forecast shown was made in two ways. First, the individual companies were asked to make their individual forecasts, taking into account all the local conditions. Simultaneously, a forecast was made by the Institute staff, taking into account forecasts of the Gross National Product, personal savings and the like. It was found that positive correlations could be established. For example, there is a relationship between the Federal Reserve Board Index of Industrial Production and the use of electricity by industry. There is a relationship between personal income and the use of residential electricity. The Institute forecast was based upon these correlations. The difference between the two forecasts was barely discernible.

The present totals of the companies' own plans for growth as well as the Institute's study of the national trends indicate that by the year 2000 the total power output in the USA will probably be in the range of 6 trillion to 10 trillion kilowatt-hours.

Based upon these forecasts, the investor-owned companies have made plans for serving the power needs of their customers and future customers through 1970 and 1980. Chart 16 shows the forecast of the peak loads of the areas served by the investor-owned companies. This also shows the capability of the power facilities planned by the companies for 1970 and 1980. Their plans include the type, size and location of generating units. Temperatures and pressures will continue to rise. Generating units will reach 1 million kilowatts in size.

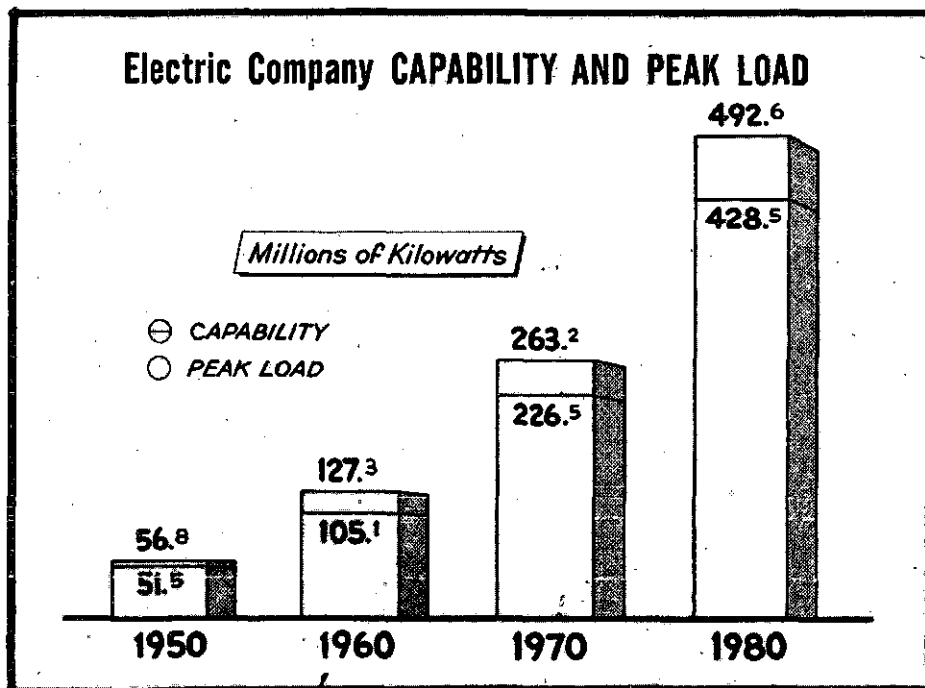


Chart 16

In 1960, for the total electric industry, 80 percent of the energy was generated by steam and 19.5 percent by hydro. A small amount of generation was by internal combustion engines. By 1980, the estimates are that there will be 86.7 percent of the companies' capabilities in steam plants, 5.2 percent in hydro and 8.1 percent in nuclear power plants.

It is expected that the use of energy and generating capability in 1970 will be about double the 1960 totals. The 1980 figures will be about double those of 1970.

The investment in electric plant by the investor-owned companies will increase proportionately as shown in Chart 17. The anticipated investment is \$88 billion in 1970 and \$168 billion in 1980.

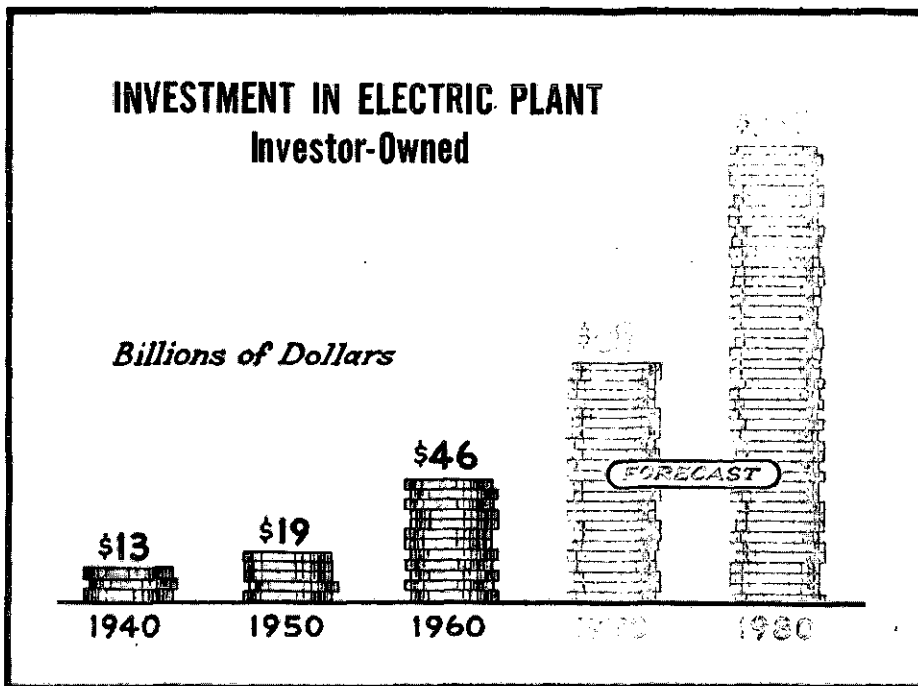


Chart 17

The new capital going into this business each year represents about 10 percent of all personal savings in the US. This is illustrated in Chart 18. It is anticipated that Gross National Product and personal savings will continue to trend upward through 1970 and 1980. With these increased trends, it is anticipated that the new capital required by the investor-owned companies will still be about 10 percent of all personal savings.

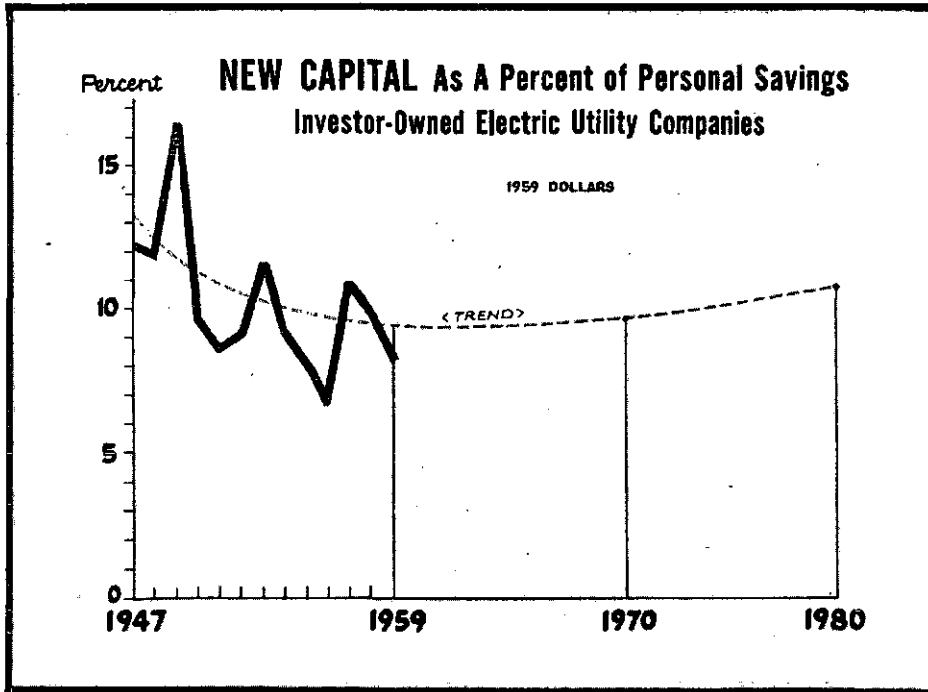


Chart 18

It is believed that this expansion program can be financed in the free market.

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