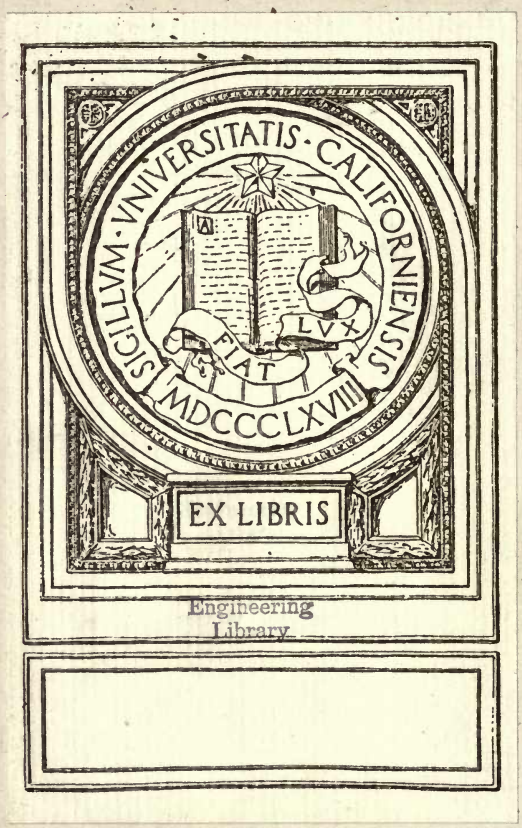
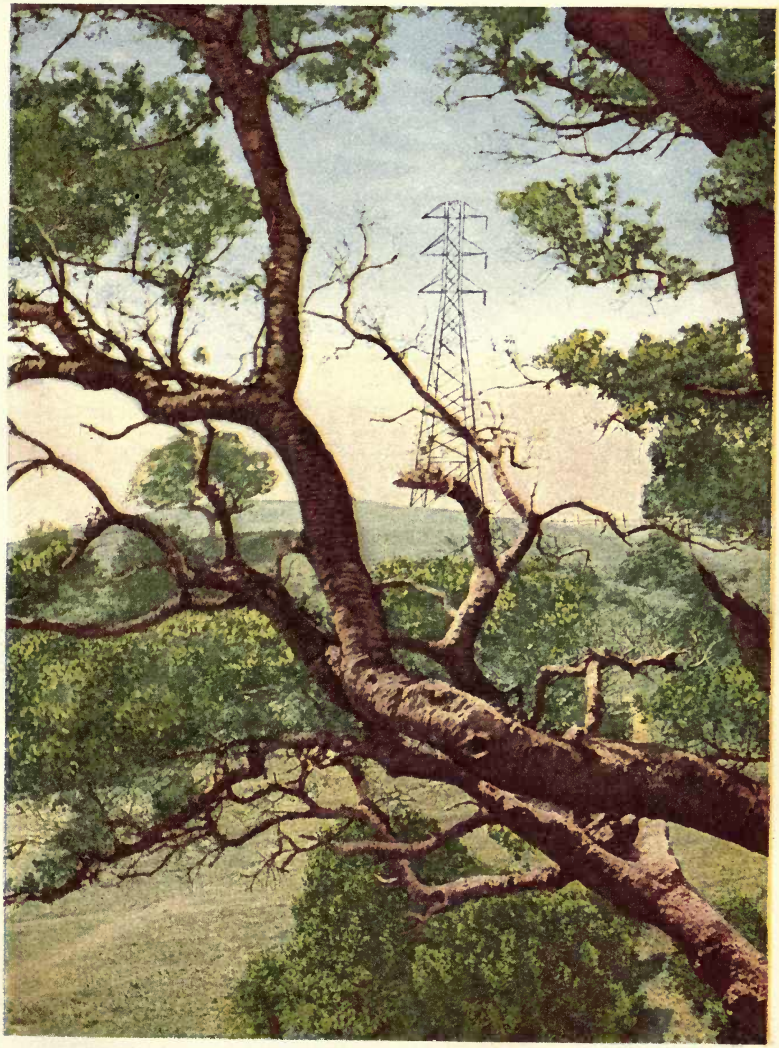


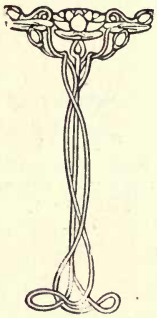
The Story of California



Supreme in Electrical Development

The Story of California

Supreme in Electrical Development



As told to business leaders
at the Pacific Coast Industrial Conference
held on June 10, 1921
Del Monte, Cal.

Journal of Electricity
and Western Industry
February 1,
1922

THE Story of California, as told to business leaders assembled in the Pacific Coast Industrial Conference at Del Monte on June 10, 1921, is the story of modern progress and development through the help of Electric Power. More than that, it is the story of how fundamentally necessary electric power is in every phase of our daily life, and of what allegiance each of us owes to the development of this great modern force.

The Pacific Coast Industrial Conference was arranged by the Pacific Coast Electrical Association, for leaders in all phases of business life in the West. The data given herein was compiled by the Journal of Electricity and Western Industry, under the leadership of its editor, Mr. Robert Sibley, from statistics gathered by this journal with the cooperation of the fifty-eight power companies of the West. As this information was gathered from four thousand industrial plants of the West, nowhere else may be found such complete data on the close relationship of **your** business to the public service industry.

The information in this booklet is given in the form of excerpts from the several addresses made by the various speakers at the Industrial Conference, and is herewith presented to the public in published form through the courtesy of the Journal of Electricity and Western Industry.

What Private Initiative Has Done for the West in Hydroelectric Development

The greatest interconnected system of power transmission lines in the world: Medford, Oregon, to the Mexican Border and up into Nevada. On January 1, 1922, there is in this interconnection over a million horsepower from hydroelectric generating plants and five hundred thousand horsepower in steam generating plants.

The largest concentrated block of electric power ever available for public use, made possible by this interconnection. The total annual electrical energy delivered to consumers in this vast interconnection is rapidly approaching four billion kilowatt hours.

The highest per capita use of electricity of any community in the world: the Western States. In one of the states the per capita consumption has reached the wonderful total of 2000 kilowatt hours. The average per capita use in the west is over twice the per capita use of the nation as a whole.

The first long distance transmission line: 20 miles at 10,000 volts from San Antonio to San Bernardino, California.

Longest high voltage transmission: 87,000 and 55,000 volts, 539 miles, from Mono county, California, to Yuma, Arizona; Southern Sierras Power Company.

Highest voltage transmission ever attempted in the world: Present record of actual operation, 150,000 volts, 240 miles, Big Creek to Los Angeles; Southern California Edison Company. The Great Western Power Company has constructed and will soon operate at 165,000 volts, a 200-mile line from its Caribou plant on the Feather River to San Francisco. The Pacific Gas and Electric is now installing a 190-mile, 220,000-volt line from Pit River to the Bay District, which will undoubtedly stand as a supreme accomplishment for many years.

Highest privately owned dam in the United States: 295-foot Lake Spaulding Dam, Pacific Gas and Electric Company.

Highest head reaction turbine in the world: two 25,000-hp., 810-foot head units in Kern River No. 3 plant, Southern California Edison Company.

Highest head hydroelectric plant in America: 2131-foot head, Big Creek No. 1, third unit, Southern California Edison Company. Plans have been drawn for three plants developing close to 2500-foot head on the Kings River and Big Creek, by San Joaquin Light and Power Corporation and Southern California Edison Company.

Largest high head impulse turbines in the world: two 30,000-hp., 1008-foot head units in Caribou Plant, Great Western Power Company.

Other large units: Two 40,000-hp., 454-foot head reaction turbines, Pit River No. 1, Pacific Gas and Electric Company; 23,000-hp. reaction turbines, White River plant, Puget Sound Power and Light Company and Long Lake plant, Washington Water Power Company.

THE West abounds in swift mountain streams, now running idly to the sea, which are susceptible of harnessing in the beneficial production of hydroelectric power. California alone can produce nine million horsepower in this way, and in the eleven Western States lie seventy per cent of the nation's undeveloped water power. On the stream shown in this illustration one power company is carrying through a development which will ultimately produce over eight hundred and fifty thousand horsepower.

Introductory Remarks at the Opening of the Pacific Coast Conference of Business Leaders

Del Monte, California, June 10, 1921

Mr. John B. Miller, President Southern California Edison Company, presiding

IT is a great pleasure to me to preside over this meeting this afternoon, which has been called for the purpose of explaining the definite relation existing between our power companies and industry. I have devoted twenty-five years of my life to bringing about a better understanding between the corporations engaged in our business, and between those corporations and the people. I have done so because I believed from the very first that to realize this ambition which is mine, and which I know is yours, is a public service. The ambition to give the very best service at the lowest rate—to be an efficient public servant—can only be realized by the thorough understanding that our interests, both between sister corporations and between those corporations and the public, are identical, and that we must have harmony if we are going to realize our ambitions.

Now, in carrying on that work I haven't been alone. I don't wish to give that idea. You all have been most generous in that same kind of service, but in carrying out that work there has been one who has been of the greatest service through the columns of his journal. He has month after month and year after year worked for that same ideal, and I know that you feel as I do when I tell you that that man is Robert Sibley, who is now going to speak to you.

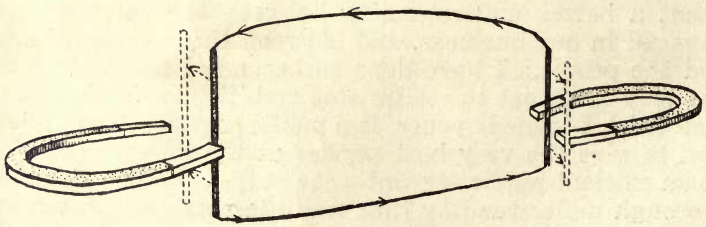
The Basic Role of Electricity

BY ROBERT SIBLEY

Editor, Journal of Electricity and Western Industry

THE subject of hydro-electricity and its generation is one of such difficulty to the layman that it seemed to me a good plan to give you one or two of the very fundamental things about it so that you may undersand what we are talking about and get some conception of what we mean when we speak of hydroelectric energy.

About a hundred years ago, to be exact, in 1830, there lived in this country a young man named Joseph Henry, and it was due to Joseph Henry, an American, that the great laws of electricity became so known that we could harness our water power. A simple experiment will give you some conception of how the thing works, as the saying goes. You are all familiar with what is known as a horse shoe magnet. Well, Joseph Henry found that when he took an ordinary wire and dashed that wire across the end of a magnet a current of electricity began to flow in



The magnet on the left in Fig. 1 represents the electrical generating equipment in the power plant. When the wire is dashed across it, a current of electricity flows along the wire in the direction shown by the arrows. The reaction between the current thus caused to flow in the wire and the magnet at the right, representing the electric motor in the factory, causes the wire to move back or forward in the direction opposite to that of the wire at the left magnet.

that wire. No one knows exactly why it does, but that was the thing he found. He was the first to discover that law. That is all the thing is, simply a wire dashing across in front of a magnet causing a current to go alternately back and forth in the city far away. And,

by the way, it is interesting to note that Henry never got the credit for that law. A man over in England by the name of Michael Faraday one year later published this law and in late years it has become known as the Faraday-Henry Law.

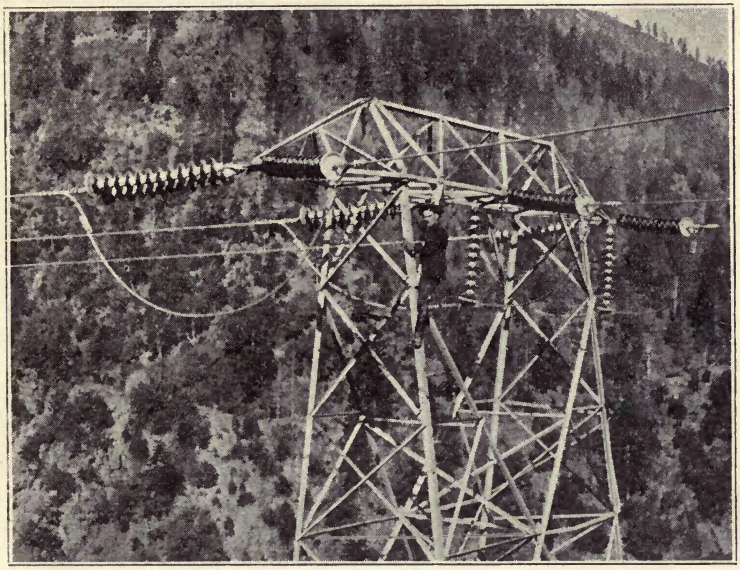


Fig. 2. The latest record in high voltage transmission—the 165,000-volt line of the Great Western Power Company.

What is shown in Fig. 2 is part of a modern electric transmission system. You can readily see that as the miles of wires go into the city it is necessary to support these wires and in supporting these wires there may be a leakage of current down to the earth. The great problem that came about in the transmission of this hydroelectric energy was to evolve some system by which there would be no leakage from the wire down to the earth. The solution of the problem came about through the development of efficient insulators, capable of withstanding these high voltages. This illustration shows the latest insulator used in the latest record established in hydro-electricity, the 165-000-volt line of the Great Western Power Co.

Now, even though this law was discovered back as early as 1830 it was not until almost three-quarters of a century later that we really began to apply this information in harnessing our water power. California has been the pioneer in this. I remember as a boy in Ontario; in

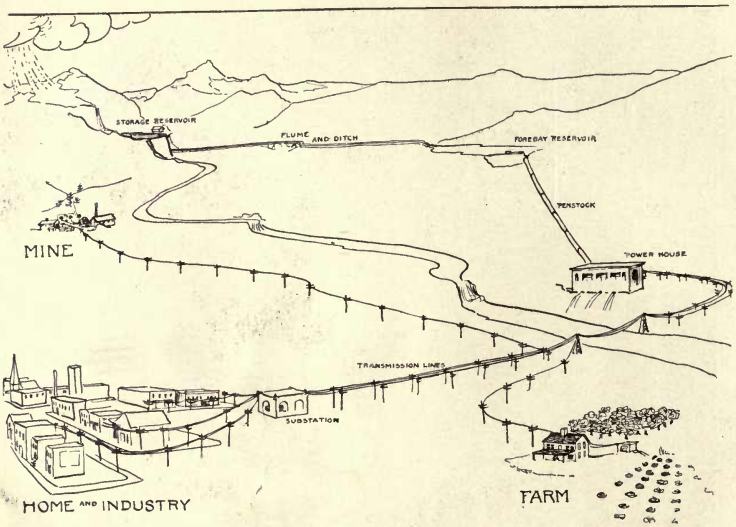


Fig. 3 is a sketch illustrating a typical modern electric power system with its hydroelectric generating project and transmission line and the distribution lines that carry the electric power to the users in homes and offices, on the farm and in the mine.

those days they pointed to the longest high tension line in the world, and that was the line running from Ontario to San Bernardino, about twenty-three miles at ten thousand volts. Today we transmit power at one hundred and sixty-five thousand volts over two hundred and thirty miles and those distances and voltages are constantly being lengthened and raised.

When we think of water power we usually think of some great Niagara. In the state of California, as a matter of fact, we don't have any great waterfalls, but we do have great gorges in the mountains making it possible for us to create an artificial waterfall, as it were, by

diverting this water, taking it out of the stream and taking it around the mountain in a ditch at a grade less than the natural bed of the stream. Then, when we build a tunnel, say eight or ten miles long, we get a difference in elevation as much as two, three or four thousand feet, making it possible to drop this water that distance.

Now, as to what a horse power means. Suppose flowing in front of us is the stream shown in Fig. 5. It is winter time and there are many chunks of ice,

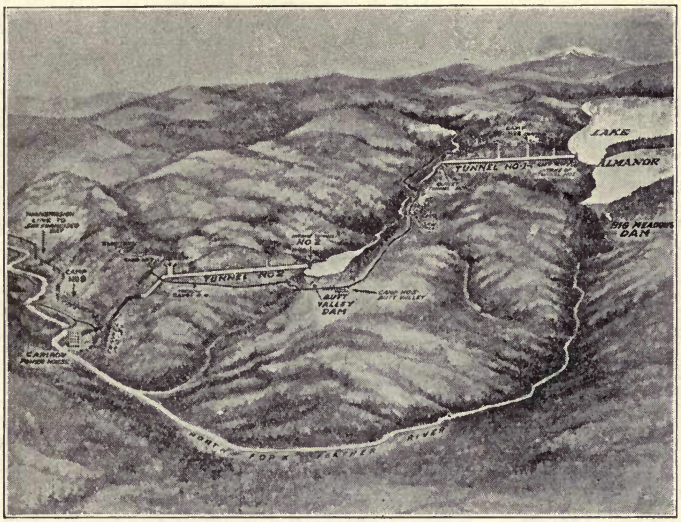


Fig. 4 is a sketch of an actual hydroelectric project, the Feather River development of the Great Western Power Company. Notice how the water is first stored in a great artificial reservoir formed by a dam, and is then carried by tunnels and streams to the point where it is dropped down to the power house for the generation of electric power.

each one measuring a foot each way, 1 cubic foot, and in front of our vision, we will say, every second passes one of these chunks of ice. Now, a chunk of ice one foot by one foot by one foot weighs about sixty-two and one-half pounds. Let that drop twelve feet and it would represent practically what a modern electric horse power represents in energy. So, when you go into the mountains and see a stream of water, picture to yourself these chunks of

ice, one foot by one foot by one foot, and picture that every time they drop twelve feet you have a horse power flowing eternally for the development of your different industries in California. That gives you the fundamentals of hydro-electricity.

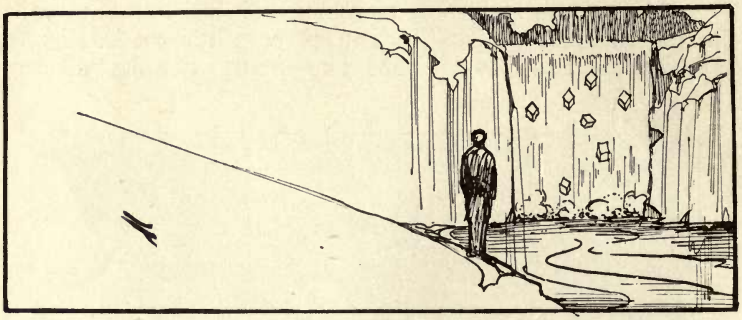


Fig. 5. One cubic foot of water per second falling twelve feet represents the equivalent of one electrical horsepower

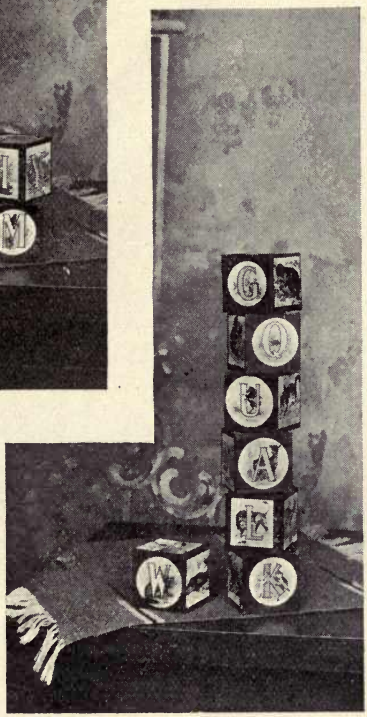
Out West here we have developed to a stage that is equaled nowhere else in America. We are talking about A B C's, so I brought some A B C blocks along. Let's see how we have developed out West. Look at Fig. 6. The single block represents the unit development back East. That is what the average citizen uses in steam and electric power back East. The average citizen out West uses just twice as much, as shown by the two blocks.

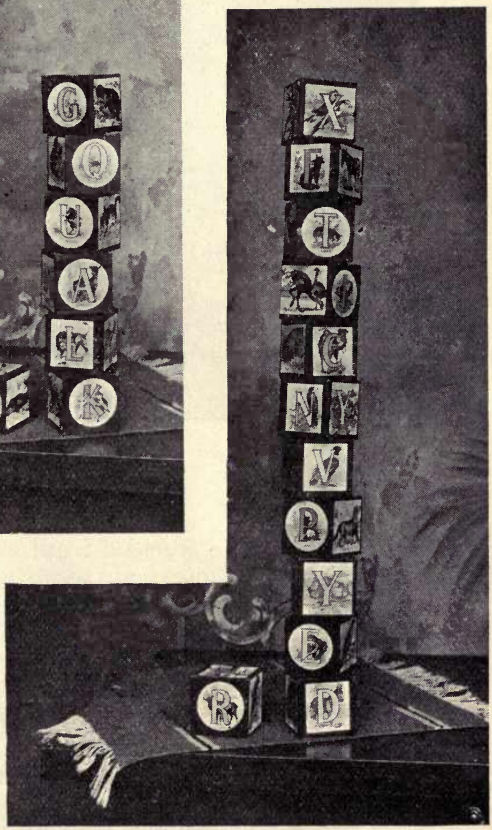
Let's take the case of hydroelectric development. The amount the East has developed hydroelectrically in proportion to their population is represented by one block, while out West we have one, two, three, four, five, six times that of the East, as shown in Fig. 6B.

Now, as wonderful as that may be, what of the future? What are the possibilities the average citizen has in regard to hydroelectric energy in the future? Refer to Fig. 6C. Let the one block be the proposition back East. Then, one, two, three, four, five, six, seven, eight, nine, ten, eleven and multiplied by two—twenty-two times the possibilities in the West as compared to the East—so you see we live in a hydroelectric domain that is equaled nowhere in the world.

A. Western aggressiveness in power development and western progressiveness in utilizing the most desirable form of power has led to a per capita development double that of the eastern states.

B. The much greater hydroelectric development in the West, per capita, is a quite natural result of western initiative and the greater abundance of available water powers.





C. The future electrical development in the West, per unit of population, will far exceed that of the remainder of the nation, because of the great preponderance of yet undeveloped water powers which are capable of being economically exploited for the benefit of western industries.

Fig. 6. Representation of comparative electrical development, East and West

Now, I am going to show some charts and pictures that will illustrate some of the wonderful physical feats that have been accomplished. You know in harnessing this great water power, our engineers have accomplished feats of engineering daring that have been equaled no-

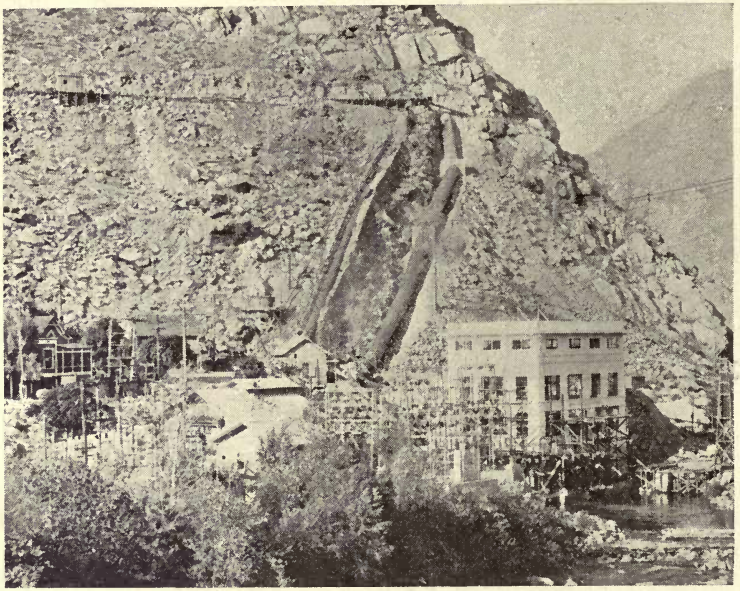


Fig. 7. Typical power development in the western mountains—the Kern River Canyon Plant of the San Joaquin Light and Power Corporation.

where else in the world. I am going to point out just a few and then show you some of our industries; what wonderful things some of our industries are doing through this giant force of electricity, and other speakers will follow, showing you how that connects with our civic and industrial life.

Now, I have pointed out what water power is. Fig. 7 shows an actual application of this idea. A reservoir has been built, and the water is brought from it in a tunnel through the mountain side, and then dropped down to the power house over on the right. That is where the electric magnet exists. Coming from it are the wires that stretch out across our valleys to feed our farms, up

In Fig. 8, you see a picture of the West in which these great transmission lines have been mapped. No other place exists where transmission lines are built to such a great extent of distribution and such high voltage. There is a solid chain of these lines from Medford, Oregon, down to the Mexican Border, and then up into Nevada, a distance of fourteen hundred miles. We have one connection of the Southern Sierras Power Company which totals over five hundred and thirty miles from the eastern side of the Sierra Nevada Mountains down to the Mexican Border—the longest transmission line in the world.

into our mines, and run the industries in our cities and to light the homes.

Let us see what is happening in the harnessing of these forces of nature. In the first place it required the building of great dams such as the genius of man never before attempted. The big one shown in Fig. 9 is a dam

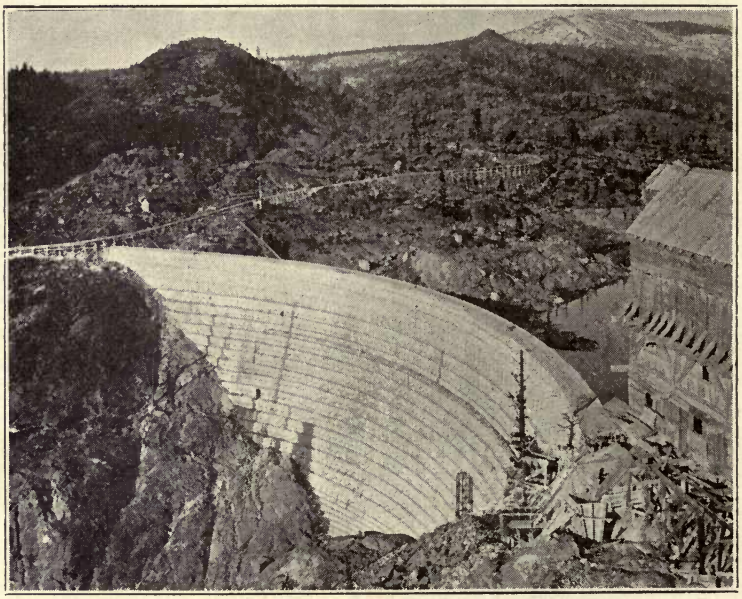
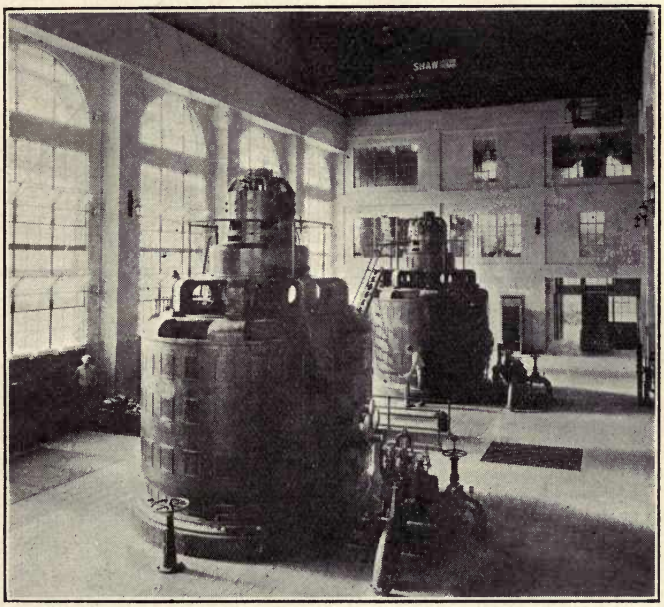


Fig. 9 shows the mammoth Lake Spaulding dam, Pacific Gas and Electric Company, while under construction. This photograph very clearly portrays the magnitude of construction work that is often necessary to harness the natural water power resources of the West, and indicates what great obstacles must sometimes be overcome. The building of this great dam, for example, required the building of a branch railroad for many miles through the mountains and the transportation of supplies across deep canyons on cables high in the air.

in California, the Spaulding Dam, which rises 295 feet above the stream bed. Let me give you an idea, in a comical way, of how much water is actually contained in such a dam. If 100,000 people each drinking a quart of water a day, started drinking about the time of Noah,

they would have drained this reservoir dry about the time the whole country went dry for another reason. But the vision of the West has not ceased there. We find our engineers today even going far beyond that vision. We hear it being talked of by the engineers that dams will be built even four and five hundred feet in height.



The two giant hydraulic power units shown in Fig. 10, are developing 25,000 hp. each, under a head of 810 feet. This is the highest head in the world for water wheels of this particular type, which, by the way, were designed and built in California. At the time they were installed, these wheels were the largest ever installed west of the Mississippi.

The installation shown in Fig. 10 breaks a world's record. It took place under Mr. Miller's supervision, in Kern River No. 3 Plant, where have been installed two of the largest hydroelectric turbines in the West. They were put into commission last month, so you see we are constantly, as months go by, expanding these records, making new records, and most all the time, mark you, it is a western record that is broken and by a western person.

It is very often necessary to stretch wires over a great distance, for instance, across streams of water and over lofty canyons. One of the crossings, known as the Carquinez Crossing, stood for seventeen years as the world's greatest and longest span of wire, almost three-

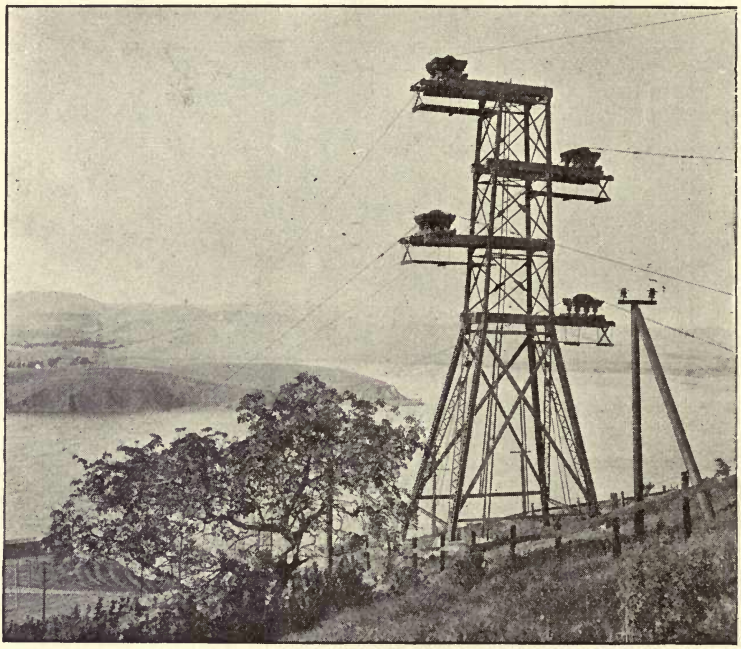


Fig. 11 shows one of the electric power transmission lines crossing Carquinez Straits, San Francisco Bay—the 4427-foot span of the Pacific Gas and Electric Company, which for seventeen years stood as a world record. Recently a second line was hung across this stretch of water—a span of 4753 feet carrying 165,000 volts for the Great Western Power Company.

quarters of a mile in length. It has been broken in the last year or so, but it took this precedent in California to give them the vision and the courage to do it.

I could go on enumerating the wonderful things that have been accomplished, but I will now allude to a few of the uses of electricity which are even as wonderful, and in many respects more wonderful than these physical

barriers that have been overcome. In the first place, Electricity in the Home. Fig. 12 is the picture of a building that was built in Los Angeles about a year ago, known as the Electrical Home. Today electrical homes are being put up in different cities to give a conception of what the modern electrical home can accomplish.

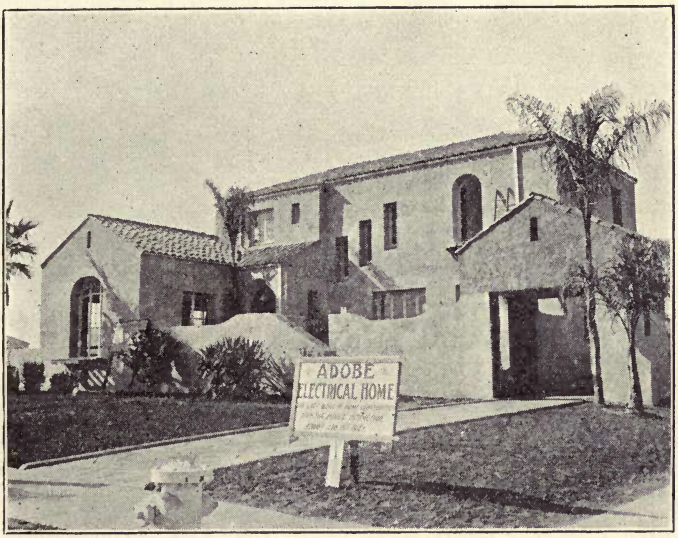


Fig. 12 is one of the numerous Electrical Homes that have been erected throughout the West to drive home the more extended use of electricity in the home. Similar homes have been demonstrated in San Francisco, Oakland, Sacramento, and in the Northwest and have been visited by thousands of interested men and women.

Those homes are electrically operated throughout—electric washing machines, electric toasters, electric refrigerators, and so on. But the wonderful thing about California is that we have developed the use of electricity in the home as nowhere else in the nation. Comparative figures tell the story. In 1910, in the districts served by central stations, California had 75% of her homes wired for electric service. In 1920, 83% of these homes were wired for service, while for United States as a whole only 35% of the homes were wired.

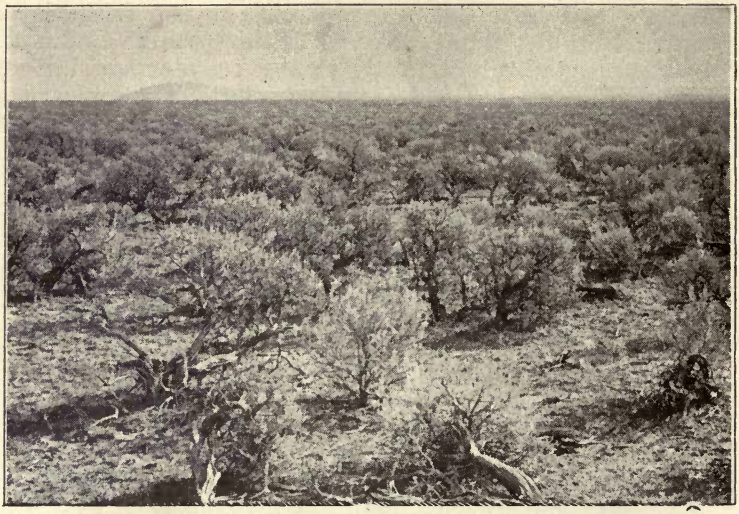


Fig. 13 is typical of the immense stretches of land in California and the West that are lying idle and non-productive because of the lack of water for irrigation.

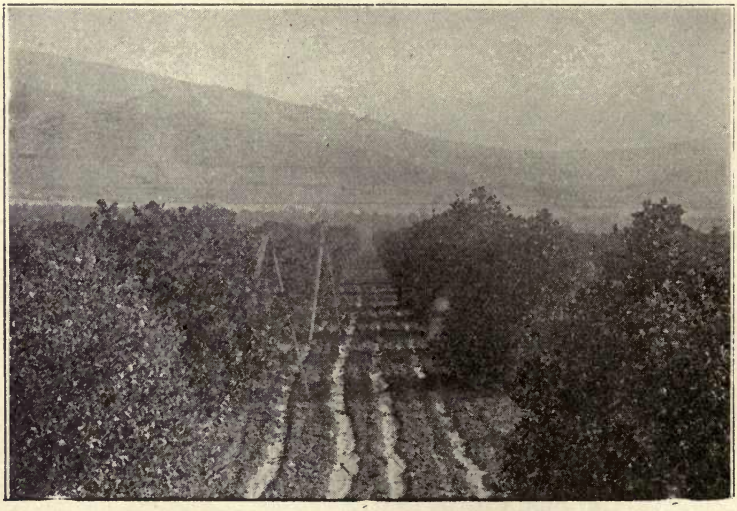
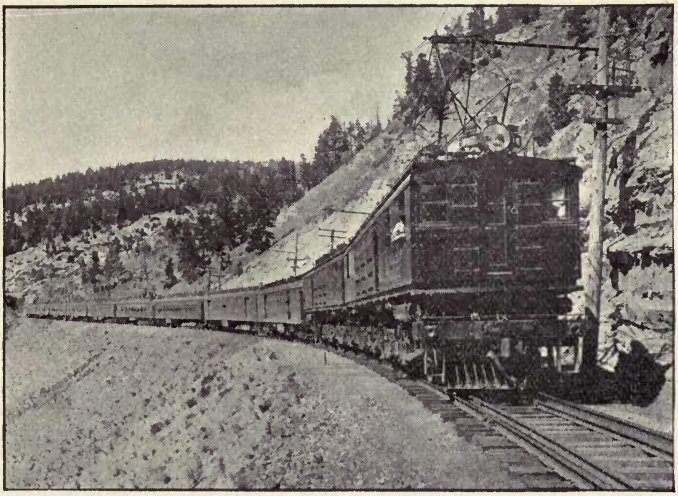


Fig. 14 shows what irrigation by electric pumping will do for idle land. The San Joaquin valley, as an example, where this photograph was taken, owes much of its present development and prosperity to the irrigation made possible by electric power.

Now electricity on the farm. Wonders have been accomplished. Acres of idle bush-covered land is the ordinary situation familiar to all of us in our barren lands in the West. As some one said in traveling all day over that land, he met only one inhabitant; that was a jack-



One of the greatest western accomplishments is the electrification of the Chicago, Milwaukee & St. Paul Railroad, Fig. 15, and today engineers are coming from all over the world to visit this great undertaking.

rabbit and he was leaving the country as fast as he could run.

Now, our land may be irrigated by gravity system or pumping the water. The gravity system has been practically completed in the West so we must rely on pumping in the future.

Over a third of the lands in California are electrically pumped and irrigated. The agricultural development in this state depends upon the way we can harness our water power, to make possible this great modern servant—the electrical pump.

There will be alluded to this afternoon the question of the use of oil on our railroads, and we all look forward to railroad electrification as a possibility in the future.

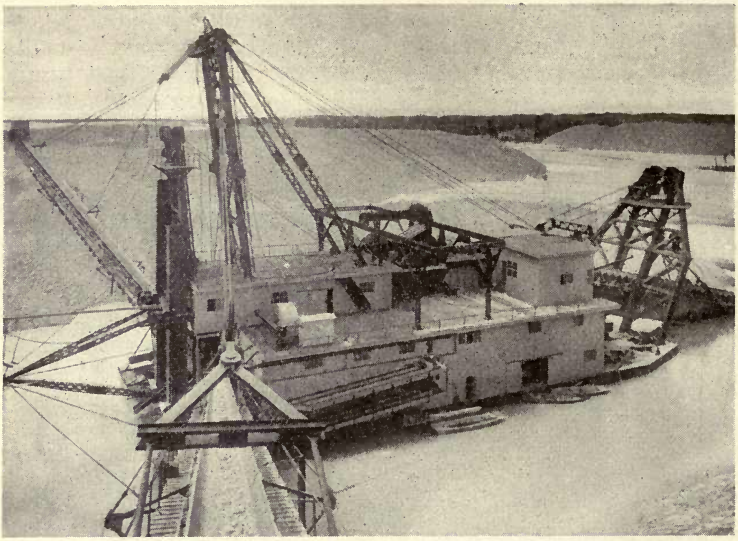


Fig. 16 shows one of the numerous electrically operated gold dredges that are at work in the West, profitably recovering gold from gravel beds that previously were allowed to lie untouched because there was no other power available that could produce the gold at a low enough rate. This is the largest gold dredger in the world. It is electrically operated throughout.

Now, in mining. It was in mining that we found ourselves, and yet if it were not for electricity today our mining would not be in anything like as good condition as it is. Fig. 16 illustrates to you the electrically operated gold dredges which today still keep California in the front rank of gold production in the United States, making possible the utilization of the old gold fields of California, scraping up the gravel, and washing out the gold even though it is in very small quantities, very often only six or seven cents a yard. They turn out the gold at a cost of only three cents a yard, through the use of electricity, and as I stated, make possible California's maintaining her first position still in the production of gold.

Other branches of mining make equally important demands upon electric power, over twenty per cent of the power sold by western power companies being used in the mines.

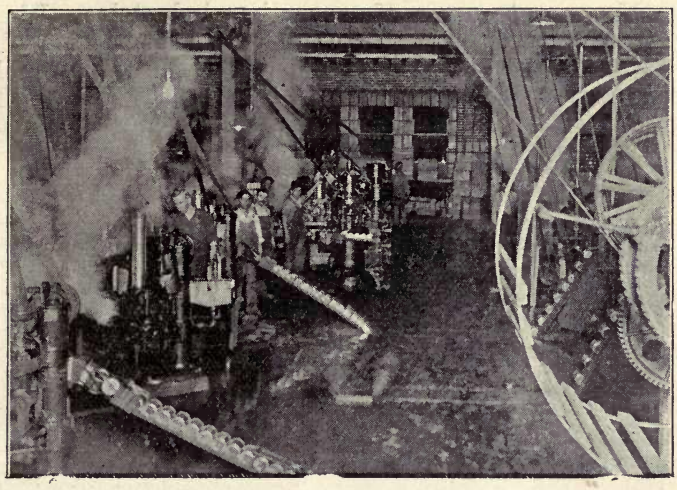
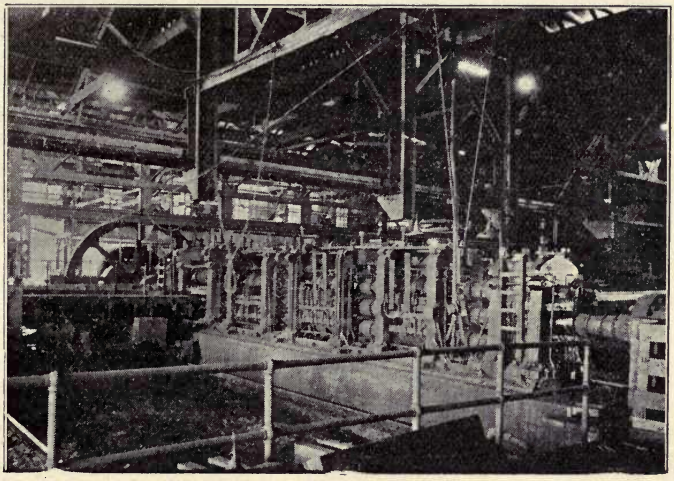


Fig. 17 shows the sanitary sealing machines in a California fruit cannery. Electricity plays a major part in preparing this great output for the market. Individual motor drive with its attendant freedom from shafting and its greater flexibility is the great advantage of electricity in this field.



The gangs of rolls in steel mills, Fig. 18, driven by single motors, require a large percentage of the power used in the mills. This photo shows a 1500-hp. motor driving a 22-inch and 18-inch mill table.

Now, as to some of our other industries. We all know that the fruit packing industry—the canning industry—is one of our great things here. Electricity makes possible the canning of fruit in the best of ways. The work is all done by machinery and a cleaner and more economic production than formerly is now possible.

Fig 19 shows an interesting use of electricity in the steel industry—an electric magnet for handling ingots. Electric current is turned into the magnet and the ingots picked up. When they have been shifted to the desired position the current is turned off and the ingots are released by the magnet. Ingots weighing hundreds of pounds are moved as easily and quickly by the magnetic crane as you or I could move a box of apples.

In the steel industry, which though new on the Pacific Coast is here to stay, a very heavy and extended use is made of electric power. One mill alone, in San Francisco, has a connected motor load of 16,000 hp., and this power is used for every conceivable kind of work. The operations in the furnace galleries, the moulding pit, ingot storage yards, transportation, rolling, cooling, cutting and fabricating shops and all other departments,

depend completely on electricity for their power. It is interesting to know, also, that this mill will be greatly dependent on electricity in the railroads, when electrification comes, as it is the largest individual shipper on a tonnage basis in the western states.

The question of refrigeration is a great problem in California. We must ship our products to the East in iced cars, and electricity plays a part in the making of ice.

The ice plant in Fig. 20 is one of dozens of such plants along the railroad lines of the West. The tremendous problem of the transportation of perishable fruit and vegetables has brought the refrigeration industry well to the front among the consumers of electric power in the West. The consumption of electricity in this industry is very large, so that the electric bill bears a greater relation to the costs of manufacture than is the case in most fields. Electricity has proved such an ideal motive power, however, that it is very generally used.

Oil itself is a fuel and yet this great modern servant, electricity, has gone into the oil fields to make it cheaper to produce oil, and cleaner than oil can do it itself.

Many of our mountain lakes and the salt beds of the desert regions have valuable chemical deposits. The production of the salts and many other chemicals has been made possible through electricity and the chemical industry in these sections has shown a tremendous growth during its five years of existence.

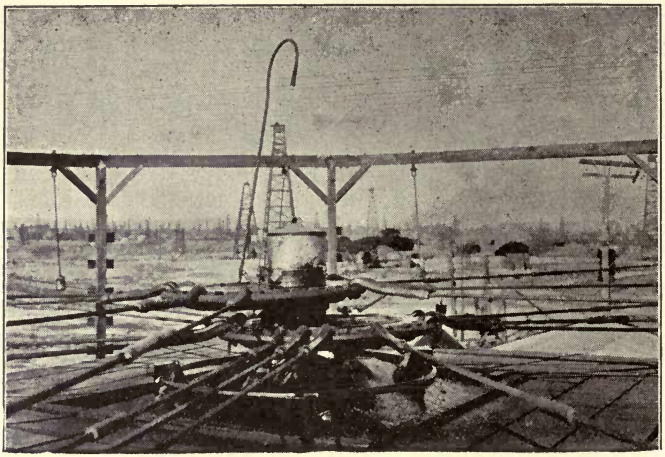


Fig. 21 illustrates the economy of electricity in the oil fields. Pumping jacks, driven by single electric motors, pump oil from dozens of wells surrounding them and do the job at a low cost and without fire hazard. The jack shown, driven by a 25-hp. motor, is pumping twenty-seven wells.

The plants shown in Fig. 22 are the Borosolvay plants of the Pacific Coast Borax Company and the Solvay Process Company at Searles Lake, California. All of this region is rich in borax and potash deposits, and electricity is used extensively in the recovery process. Over 11,000,000 kw-hr. were used by the chemical plants of this vicinity in 1920.

I will briefly show you in a statistical way some of the ways electricity operates. In the western states 14% of the electric power developed goes for lighting homes; 26% goes toward operating railroads; 28% toward manufacturing; 11% toward agriculture. In California the

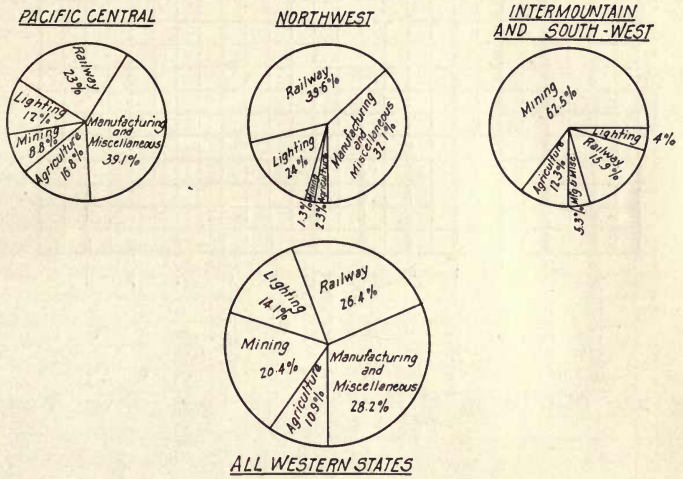


Fig. 23 gives the distribution of load of the western power companies. California and Nevada, represented in the Pacific Central division, show particular activity along the lines of agriculture and manufacturing, while Northwest development centers in manufacturing activities, and the Intermountain and Southwestern districts are especially well represented in the mining field, with a sprinkling of agriculture.

amount of electricity used for agriculture is much more, being 17%.

Now, as to some of the general proportions, to show you what proportion of electricity is used in the various industries. You notice the metal trades is first; food production comes next, and so on down the line, which gives you an idea as to the proportionate uses of electricity in the various industries.

Now, as to what a single plant uses. The plants having the largest installed capacity are the steel manufacturing plants, as I have said above. The average plant reporting to us in this survey used almost ten thousand

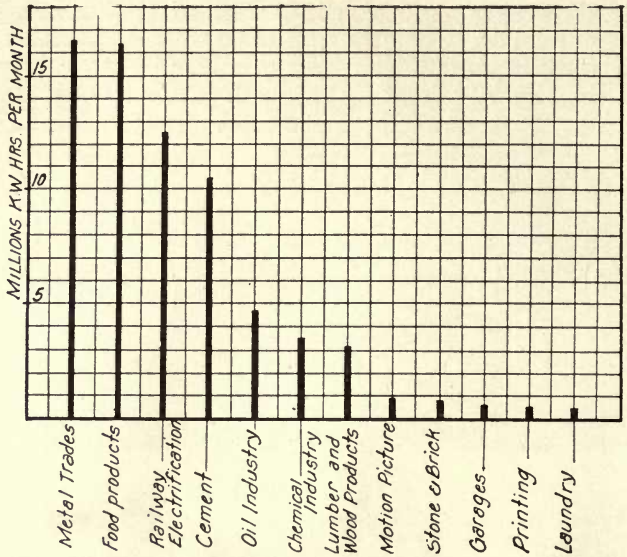


Fig. 24. Distribution of Manufacturing Load — Seven Western Power Companies

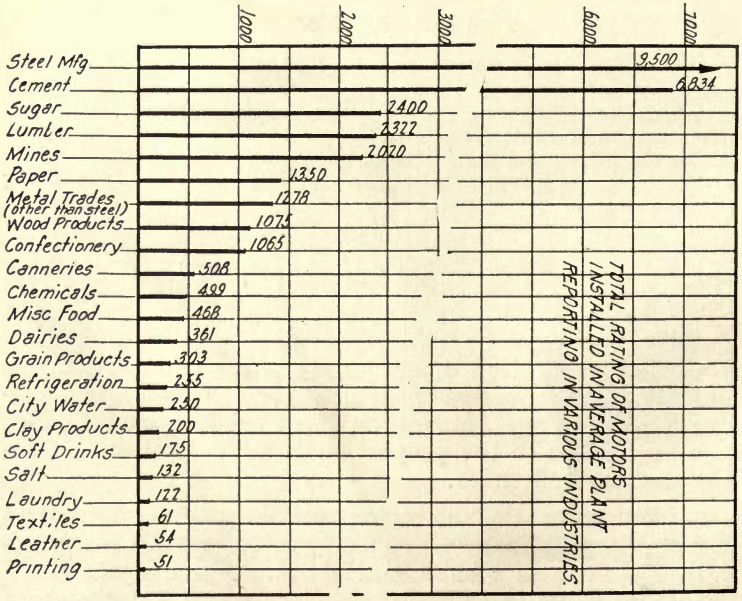


Fig. 25. Installed Capacities of Motors in Average Plant

horsepower. The next industry is the cement industry. Then, along down the line is the chemical industry. I am calling your attention to the chemical industry to show you that in some instances, although there is a large horsepower installed, the relationship varies when you come to the actual power consumed.

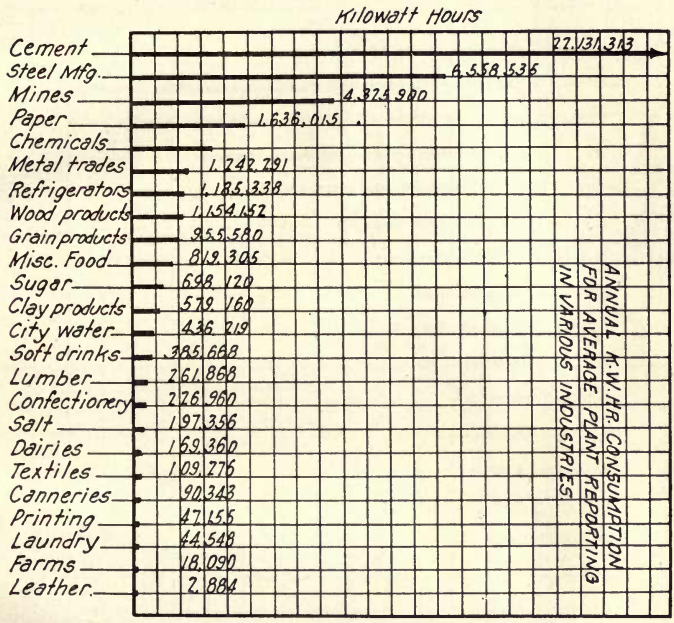


Fig. 26 gives the relative annual consumption of electric power by the various classes of western industrial plants

Cement plants actually used more power, although the steel plants have the largest installed capacity. That is because they use it continuously and the other fellow only on and off. The chemical industry, you notice, made quite a step toward the front. The chemical industry can probably get a much cheaper rate.

Another interesting way of regarding electric power and its value to industry is to compare the value of output of any industry and the kilowatt-hour consumption

required in its production. Or, expressing it another way, how much the production is in dollars and cents for every kilowatt-hour of electric power consumed. The meat packing industry produces $12.46 worth of goods for every kilowatt-hour consumed; fruit canning, $11.35; dairy products, $8.90, and so on. This gives a conception of how dollars and cents are made for industries of this country by the utilization of electric power.

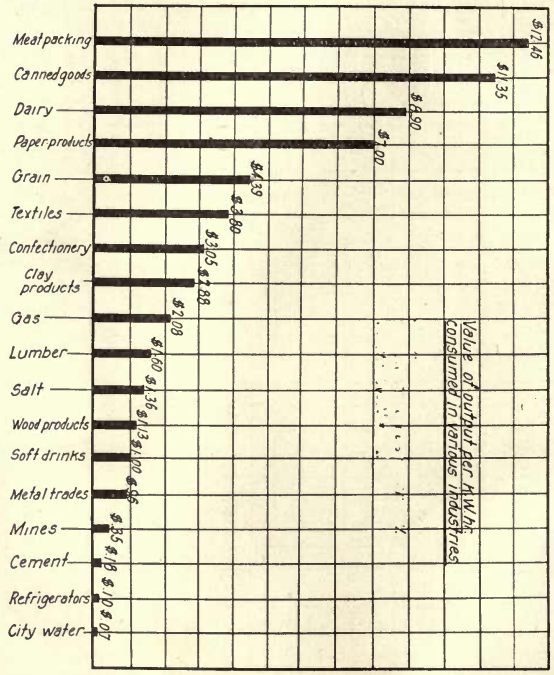


Fig. 27 is the converse of Fig. 26, in that it indicates the value of the output per kilowatt-hour used. The average charge made for this kilowatt-hour at current western rates is about 1.3 cents—a very small fraction of the total cost even in those industries using the largest amount of power per unit of output.

Irrigation and pumping in the West shows a decided reaction to electricity. Irrigation by the gravity system has remained practically the same, but electrical pumping from 1910 to 1920 took a decided jump and has been

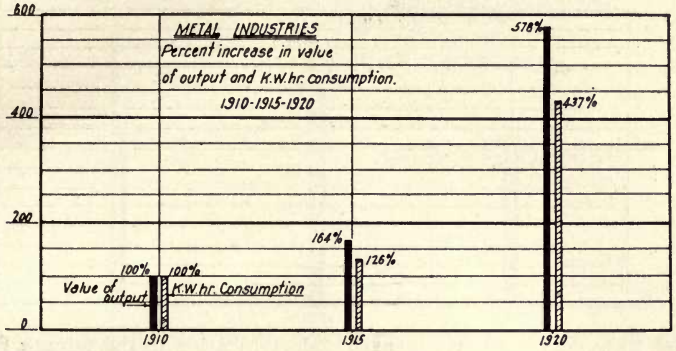
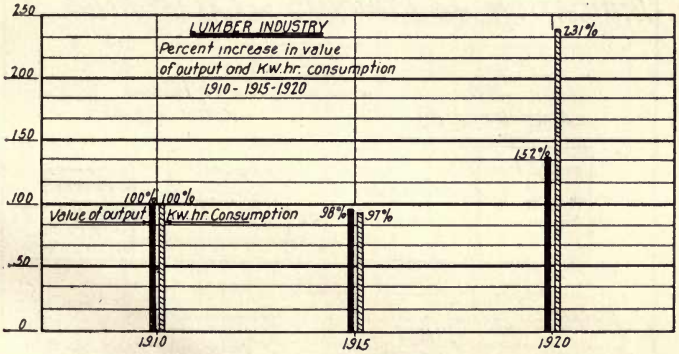


Fig. 28 indicates how the remarkable growth in the value of output in the metal industries has been matched by the kilowatt-hour consumption. When the difference in the value of the dollar between two years is taken into consideration, it is apparent that the use of electricity has increased intensively as well as extensively in this period.



The increased consumption of electric power in the lumber industry, indicated by Fig. 29, is due to its more extensive use for operations which were previously performed manually. The increased use of electric power has obviated the necessity of taking on additional employes, even in the face of increased production requirements.

going on at an increasing rate ever since. This shows very conclusively that the future development of this state in agriculture depends upon the development of these hydroelectric resources.

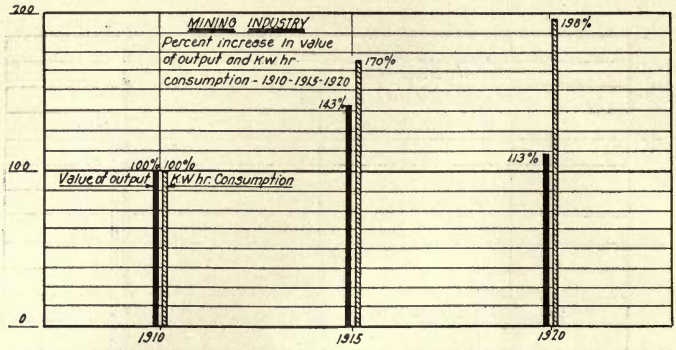


Fig. 30 indicates a more intensive electrification in the mining field. Despite the slump in mining activities indicated by the 1920 output figures, the use of electricity in the mines reporting had materially increased. The fact that the number of men employed had decreased at a greater rate than the output is a confirmation of the greater use of electrically operated machinery in the individual mine.

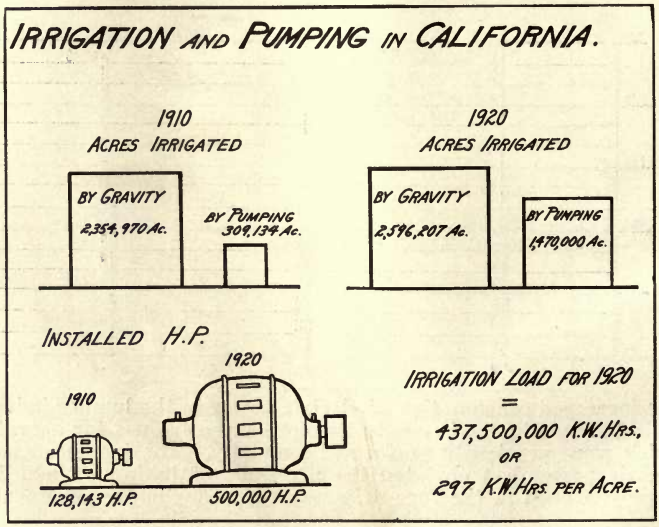


Fig. 31 shows clearly that almost the entire increase in irrigated acreage in California has been pumped irrigation. At the present time more than one-third of all land irrigated in the state is served with pumped water. 1920 figures on installed horsepower are based on government estimates—and indicate the tremendous market for small motors which has opened up in this field.

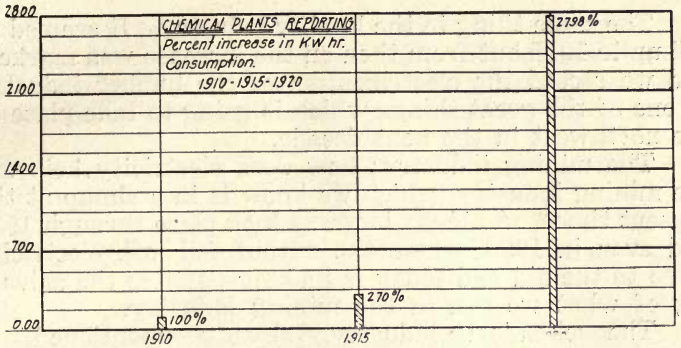


Fig. 32. Increased Use of Power in Chemical Plants Reporting

Charts which show how electricity started and developed in ten years in various industries are decidedly interesting. In the metal industry in 1910 there was a hundred per cent product and a hundred per cent use of electricity; in 1915 the use of electricity increased to 164 per cent and jumped up to 578 per cent in 1920.

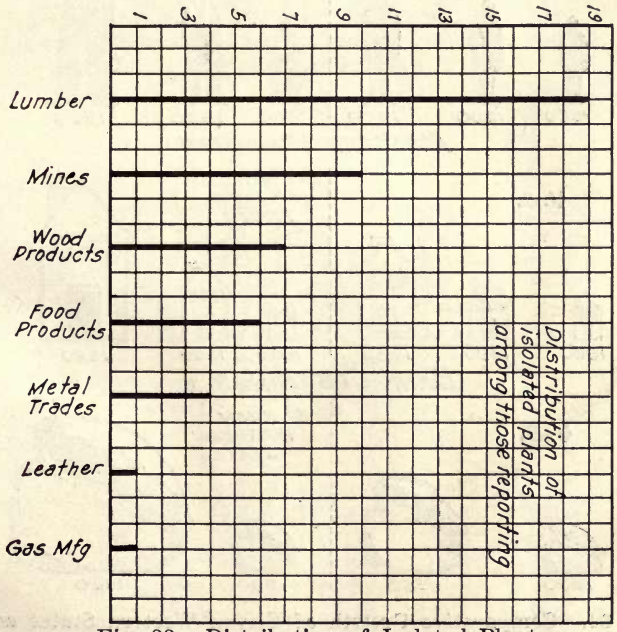


Fig. 33. Distribution of Isolated Plants

The same thing in the lumber industry. It seemed to fall up to 1915 but from then on the increase was marked, and we record the electrification of the lumber industry as one of the great things which is going to take place in the northwest in the next decade.

The mining industry; how does electricity help out the mining industry, which we know is in a slump at the present time? A steady increase took place through 1915 and even in 1920, when the output fell off, electricity came to the aid and today is making possible the salvaging of what we can in the mining industry.

The chemical industry, already mentioned, is another one that has had a wonderful growth during the past few years, because of the economies and efficiency possible in the use of electric power.

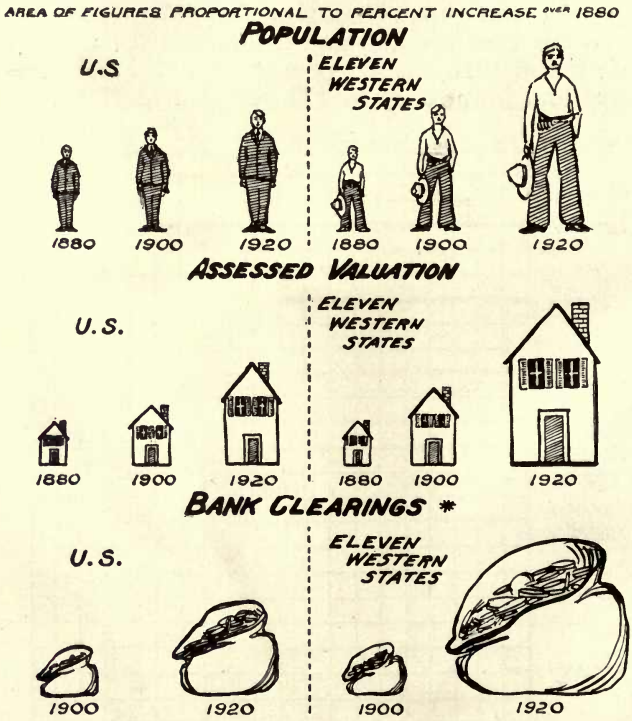


Fig. 34. Comparative Growth of Eleven Western States and United States

This will give you an idea as to how we are growing out West as compared with the East. The only thing we have gone backward in is mining which has experienced quite a slump at the present time.

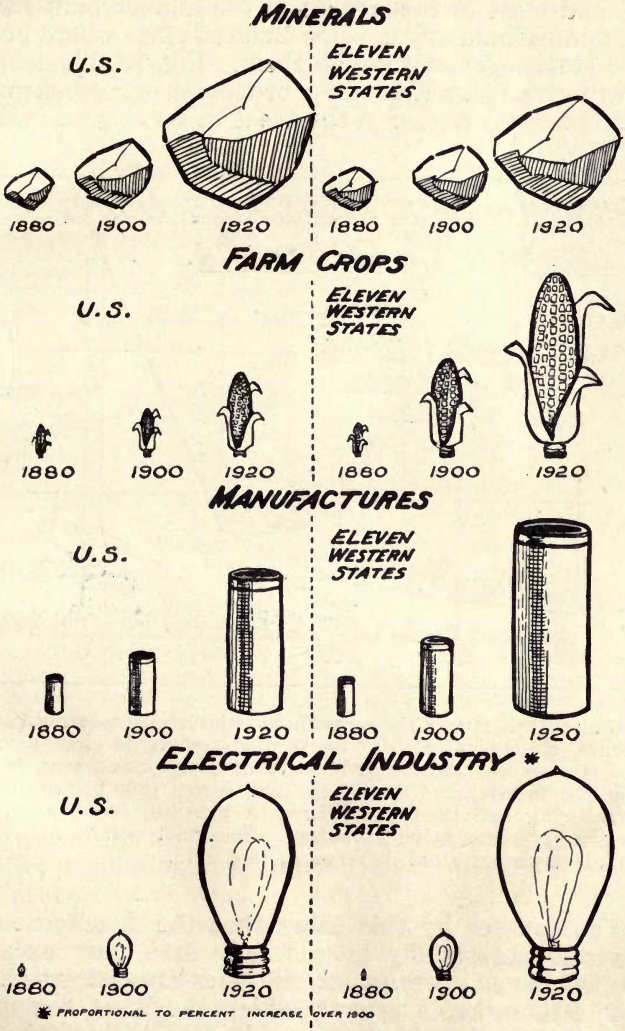


Fig. 35. Comparative Growth of Eleven Western States and United States

We sent out four thousand questionnaires to industries to find out who was serving them and we found out that our great public servant in the West was serving practically every one of those four thousand. Only about fifty were being served by their own individual power plants and most of those were in the lumber industry or in the mining industry in some isolated place where public service stations cannot get to them. Fig. 33, illustrating this, will give you an idea how broadcast our great public service industry is here in the West in serving our needs.

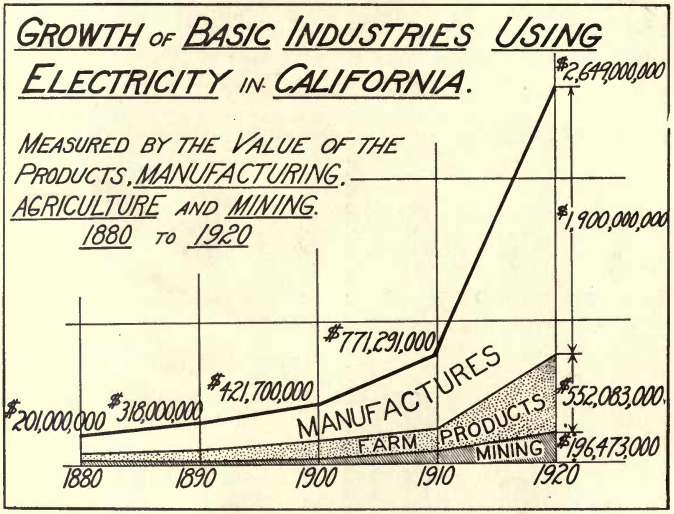


Fig. 36 clearly portrays the growth in industrial importance which California, as typical of the western states in development, has made. Mining was the major activity of early years, soon supplemented and outdistanced by agriculture. From 1880 to the present, manufacturing activities have shown a growing importance, now ranking first in the value of output. The past decade has shown the greatest proportional increase in this field.

You can see by this chart that the development of California industrially is certainly in a very excellent shape, so far as government statistics are concerned.

The remarkable growth which the West has made, in every line of endeavor, would seem to indicate that electricity is a vitalizing force in our daily life. In popu-

lation, assessed valuation, bank clearings and business transactions, farm and factory production and kindred lines, the increase in the past few decades has been very impressive. But it remains for the electrical industry to run far ahead of any other and to pave the way for the more rapid increases in the dependent industries.

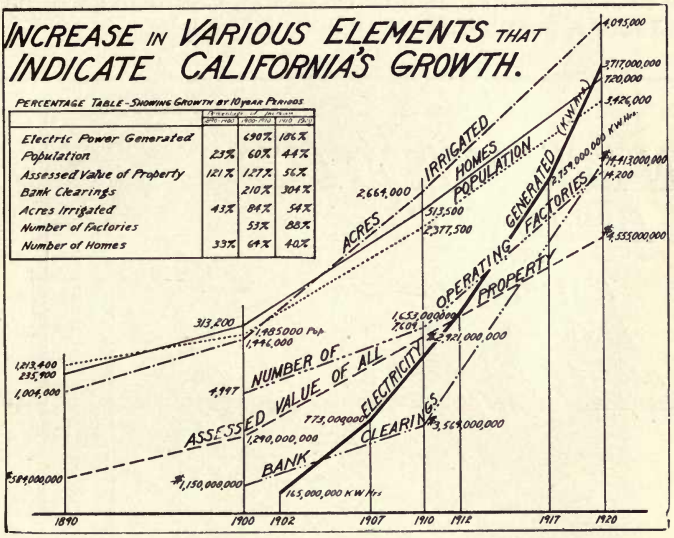
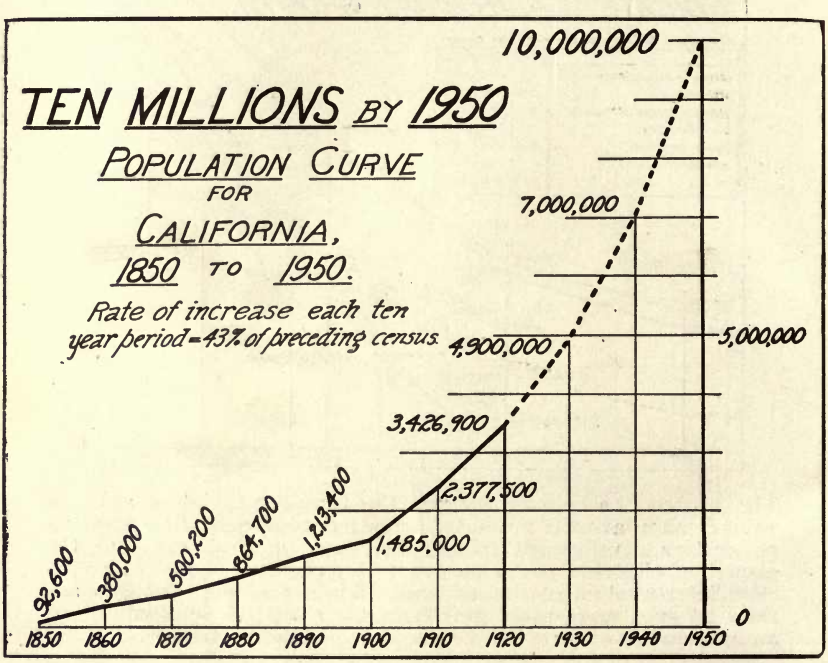


Fig. 37 shows how closely the growth curves of population, assessed values, manufactured products, acres irrigated and other features of western development follow the same general curve as the growth of electrical power output in this region, demonstrating the close inter-relation of this advance. Figures of per cent increase show an even more rapid growth in the electrical field, indicating an even greater use of power per unit of other activities.

In closing, I want to take up one other vital phase of our life, population, and in doing so to project a look into the future to see what it holds for us. We very well know that population and electric power are closely related, but that while electric power must depend on population for an outlet, population is even more dependent on electric power for growth. In other words, power must be on the job or available before population can increase to any great extent.

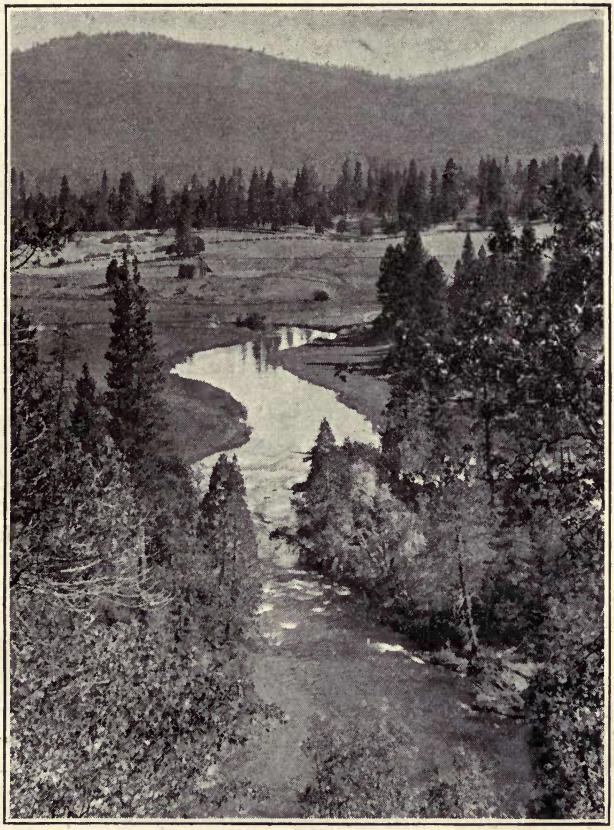
California, as one of the largest states, showed the fastest rate of growth of any in its class during the last census decade. In view of the possibilities of individual achievement and community growth in this great empire in the making, through the benefit of unequalled hydro-electric resources, this rate should be exceeded in the next few years to come. But even holding its growth to the rate at which it is now traveling, California will have, by 1950, a population of 10,000,000 people.



The population curve of California, Fig. 38, shows that there has been a steady increase in population during each decade. The growth during the last two ten-year periods has been markedly faster than for the previous years, and the present rate of increase of forty-four per cent is not unlikely to be maintained for some years to come. It is on this basis, therefore, that the above curve has been computed.

This is a truly marvelous accomplishment, but it will surely not be attained without the great, widespread assistance of electricity as a motive power. I urge you to

guard jealously the health of this industry. In view of the possibility of the enactment of laws that would hinder this wonderful development, I leave with you the same message that St. Paul gave to the Thessalonians 1900 years ago, "Therefore, my brothers, let us not sleep as do others, but let us watch and be thoughtful."



Over 350,000 hp. are to be added to the capacity of western power companies during 1922, according to schedules announced by the companies themselves. This peaceful scene is on Hat Creek, California, just below the Hat Creek No. 2 power house, part of the great Pit river development of the Pacific Gas and Electric Company, now under way. This development will eventually bring in 575,000 hp. which will be transmitted to San Francisco at the record breaking voltage of 220,000 volts.

The Future of California Power

BY H. G. BUTLER

Former Power Commissioner, State of California

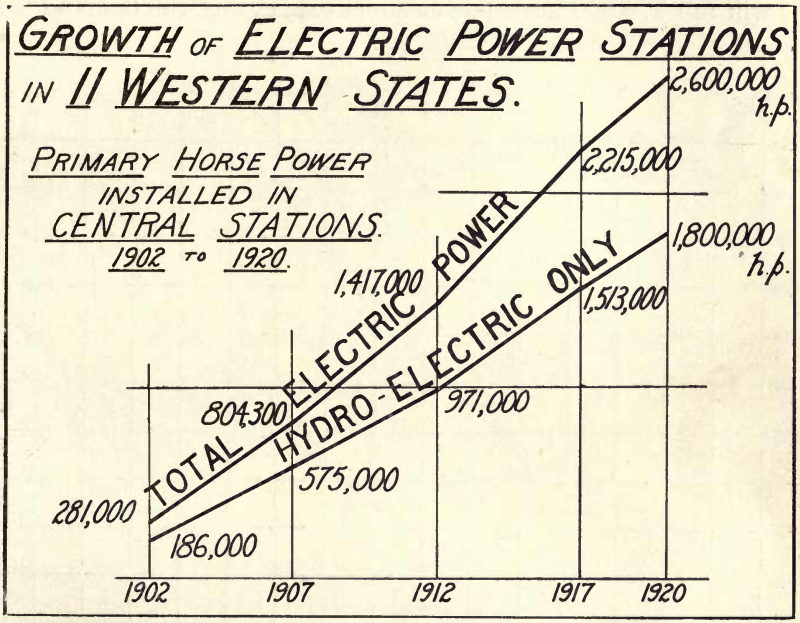
THE safest—in fact the only way to forecast California conditions is to say that if the factors which have thus far forced industry ahead remain unchanged, the future can be foretold mathematically with tolerable accuracy. The first thing needed is a knowledge of what the facts are; then an examination of these facts, which are few and readily analyzed.

From 1913 to 1920 the average horsepower used in California grew from 301,000 to 549,000, as each year during the last five years the demand has averaged more than a 10 per cent increase over that of the previous year.

In 1920 the peak load on the plants of the California power companies was some 893,000 horsepower, with the plants in the northern portion of the state carrying a load which left them no margin of safety whatever. The companies in the south had a slight surplus, but taking the two together the peak could be met only by using all available equipment to a much higher degree than is normally safe in operation. This 893,000 horsepower of 1920, then, can be taken as the maximum peak capacity of the plants in existence at that time, and the rate of growth for the past five years—10 per cent—as the normal growth.

In the fall of 1920 there were under construction in the state, plants which would increase the generating capacity about 386,000 horsepower. By August of this year, when the peak load period for 1921 is reached, some 190,000 horsepower will have been added to the capacity available in 1920, and the peak capacity of the interconnected companies will be approximately 1,083,000 horsepower. Estimating the peak load for this year from the average increase for the past five years, it will be about 980,000 horsepower. The reserve for the year will be 103,000 horsepower, which means that after all the hydroelectric power is utilized 356,000 horsepower of steam, 78 per cent of the total steam capacity, will have to be pressed into service.

Before the peak load of 1922 is reached an additional capacity of 127,000 horsepower now under construction will have been added, so a peak load of 1,210,000 horsepower could be carried, while the estimated peak load will be 1,084,000 horsepower, a reserve for that year of 126,000 horsepower, or 31 per cent of the steam.



Steady and substantial as has been the development of electric power generating plants, and particularly those of hydroelectric power, it has not been fast enough to keep up with the demands of industry. Notice how great has been the demand on the steam stations, Fig. 39, during the last few years. With a diminishing supply of oil available, water power must take over an even greater share of this rapidly growing load.

By the summer of 1923 one more plant will have been completed and the figures stand: peak capacity 1,223,000 horsepower; probable peak load 1,200,000 horsepower; reserve 22,600 horsepower, too small to speak about.

Late in 1923 the Hetch Hetchy plant of 66,000 horsepower should be completed. The peak capacity of the state in 1924 will then be 1,289,000 horsepower, while the peak load will be 1,325,000 horsepower. The generating capacity will lack 37,000 horsepower of carrying the load.

If the estimate is extended one year further, the peak will have grown to 1,464,000 horsepower, while the capacity has not increased, and the power plants of the state will fall 175,000 horsepower short of meeting the demand.

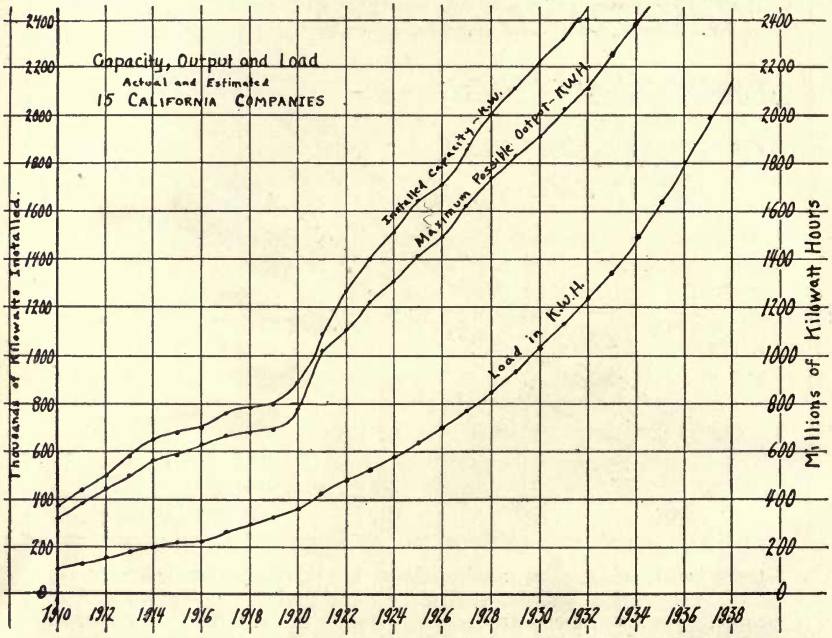
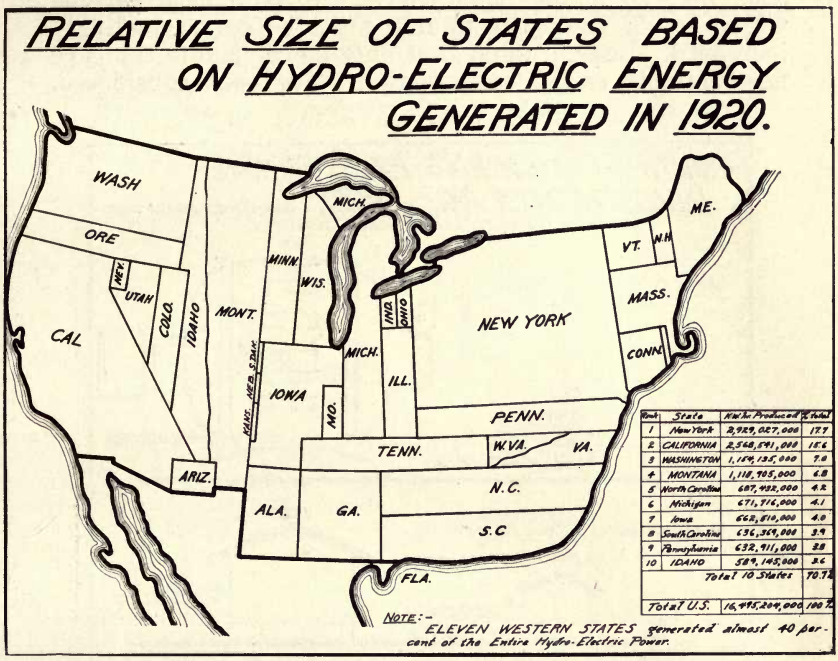


Fig. 40 gives in more detail the relative situation of load and capacity, besides projecting the probable requirements a number of years into the future. The related curves for installed capacity and maximum possible output are based accurately on the data given by the fifteen California companies interviewed, and the curve is carried into the future in line with the announced plans of these companies. The load curve is made in accordance with what has been found to be the present situation, namely, a consistent load increase of 10% yearly. While this increase is very likely to be greater in the coming years, the 10% increase curve shows what the power developments will have to be to keep up with it.

These statistics can be summarized thus: In 1925 the 386,000 horsepower which was under construction in the fall of last year will have been entirely absorbed, and the resources will be 175,000 horsepower short of require-



An effective way of emphasizing the growth of the hydroelectric power industry of the West is to graphically compare it with that of the entire nation, state by state. Fig. 41 shows how the United States would look if the area of the states were proportioned to the number of kilowatt-hours generated by water power during 1920. New York, with its nearly completed Niagra Falls development is first, but California, just getting well under way in hydroelectric development, is second and is followed closely by Washington and Montana. Of the nation as a whole, the section west from the Rocky Mountains generated nearly 40 per cent of the total amount.

ments, even if all the steam plants are used to the limit. In other words, in four years the power companies of the state, if they are to meet needs in the future as great in proportion as those they have met in the past, must plan

for, finance, construct, and place in operation three and one-third such plants as Caribou, or two and two-thirds plants of the capacity of Hetch Hetchy.

These figures presuppose perfect interconnections and a complete utilization of the power available to every company. If at any time there is to be a local surplus which is not used, the figures must be correspondingly increased. Bear in mind that only power plants that are now actually under construction have been considered,

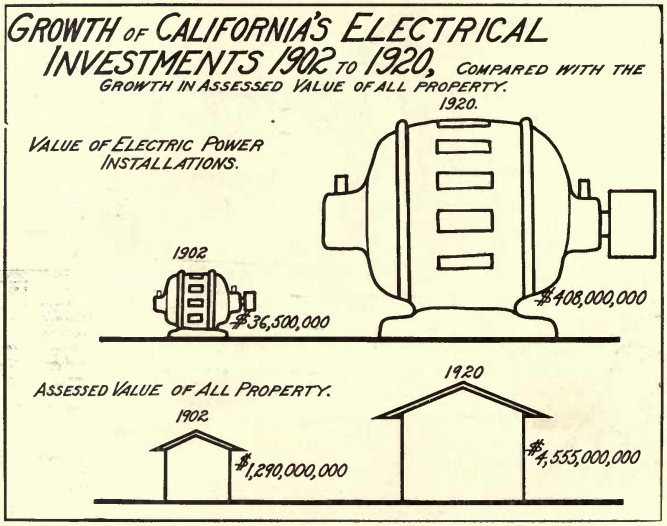


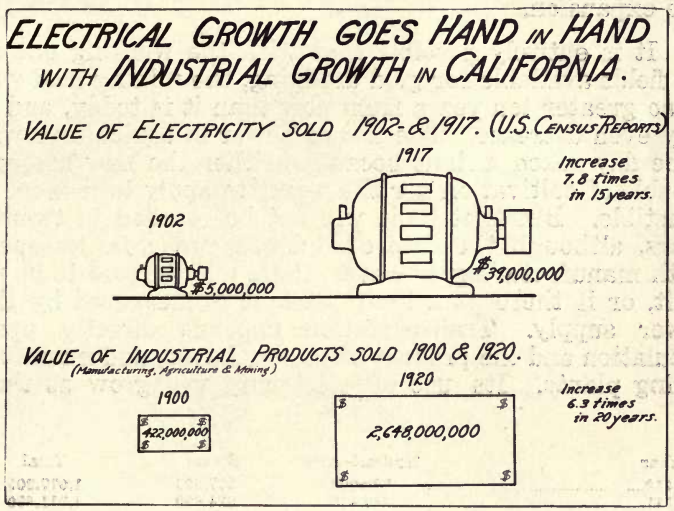
Fig. 42 shows that the electrical industry ranks high among the industries of the West, even when considered solely from the standpoint of the actual investment involved. Progress figures indicate a growth which has been more rapid than that of other western development as reflected in the figures of assessed property values.

and all the larger companies have programs calling for additional construction in the near future.

Several estimates have been made of the limits to which California's water power can be economically developed. Although these estimates have all been based on the same data, the modifying factors which have been introduced have resulted in what are practically independent estimates. The most conservative and reliable esti-

mates range from 5,000,000 to 7,000,000 horsepower. It is probably safe to say that when the state has developed to the extent of 6,000,000 horsepower, the economic limit will have been reached.

If the present rate of increase is continued, in 1941, twenty years from now, this 6,000,000 horsepower will have been entirely absorbed. Is it any wonder that far-



Comparison in the growth of sales of the electrical industry compared with all industry in the West, Fig. 43, shows the healthy condition in this field, which is increasing at a faster rate then almost any other line of business.

seeing men—men who are familiar with the power situation and are entirely practical — are already looking beyond the boundaries of the state for power which can be developed for use in California as well as in adjacent states?

Bearing in mind that if the present rate of growth continues, there is no use in projecting the power load beyond the year 1941 without looking to the Colorado River to the east, the Columbia and the other streams in Washington and in Oregon to the north,—which means that we are considering not California but the entire

West,—it is necessary to analyze the factors which are now making for growth to see what the prospects are of maintaining the present rate until the limit of economical development has been reached.

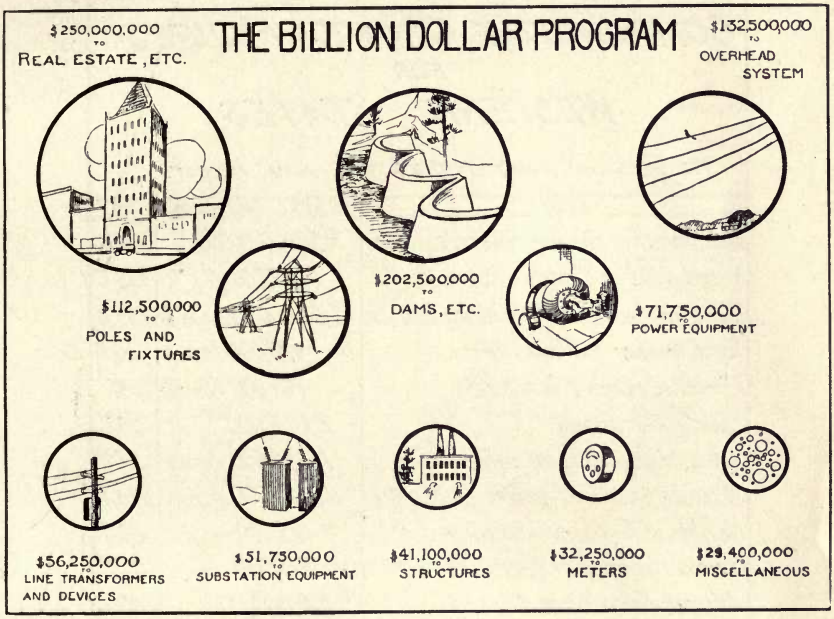
The main uses of electricity can be roughly classified as mining, agricultural, manufacturing, transportation, and domestic. All of these five classes are more or less interdependent, but all of them are not capable of indefinite expansion.

It is entirely possible that with the working out of the fields available for gold dredging, the mining load will be no greater ten years from now than it is today, and it may even decrease. The use of power in agriculture will some day reach a limit because neither the new acreage capable of cultivation nor the water to apply to it is inexhaustible. But that limit will not be reached in twenty years, although the rate of increase may be lessened. With manufacturing, however, there may be said to be no limit, or if there is a limit, that it is measured by the power supply. Transportation depends directly upon population and the product of mines, farms, and manufacturing plants. Its use of electricity will grow as they

Year	Hydroelectric	Steam	Total
1910	800,000	277,300	1,077,300
1911	886,910	324,690	1,211,600
1912	943,010	412,220	1,355,230
1913	1,051,540	467,251	1,518,791
1914	1,175,800	512,870	1,688,670
1915	1,332,430	542,580	1,875,010
1916	1,433,050	545,200	1,978,250
1917	1,566,390	554,680	2,121,070
1918	1,673,350	558,800	2,232,150
1919	1,701,546	619,344	2,320,890
1920	1,826,164	671,586	2,497,750
1921	2,116,500	742,350	2,858,850
1922	2,366,650	823,740	3,190,390
1923	2,728,670	861,330	3,590,000
1924	2,957,900	911,590	3,869,490
1925	3,210,040	943,760	4,153,800
1926	3,352,530	970,570	4,323,100
1927	3,630,280	973,260	4,603,540
1928	3,978,000	978,620	4,956,620
1929	4,177,740	978,620	5,156,360
1930	4,370,770	981,305	5,352,075

Fig. 44 given in tabular form information similar to that given in chart form in Fig. 39. In addition however, it gives the estimated tables of steam and hydroelectric capacity for each year up to 1930, based on the proposed developments of the privately owned public utilities.

grow, after it takes the first leap and substitutes the electric motor for the steam engine—a thing that will certainly be done within the next few years. Domestic consumption, which is a function of population, will keep a step or two in advance of the growth of all industry as



What this great construction means to various other industries is portrayed in Fig. 45. The work which is contemplated during the present decade will amount in total figures to close to one billion dollars. To whom this huge sum will go is shown in this chart.

long as new appliances continue to make power more and more a necessity in the home.

The ever-increasing cost of the fuels and the uncertainty as to where these mounting costs will stop is strong enough to compel manufacturers to locate where hydro-electric power is available.

If this brief analysis is correct, the sequence of events in the process of building up and growing is, first the power, then more factories, more transportation, and

more domestic consumers to use it. But the power must be first. A slump in development—a cessation in the building of power plants for even one year—will be at once reflected in a slowing down of the industrial growth

COMPARATIVE GROWTH FIGURES FOR WESTERN STATES.

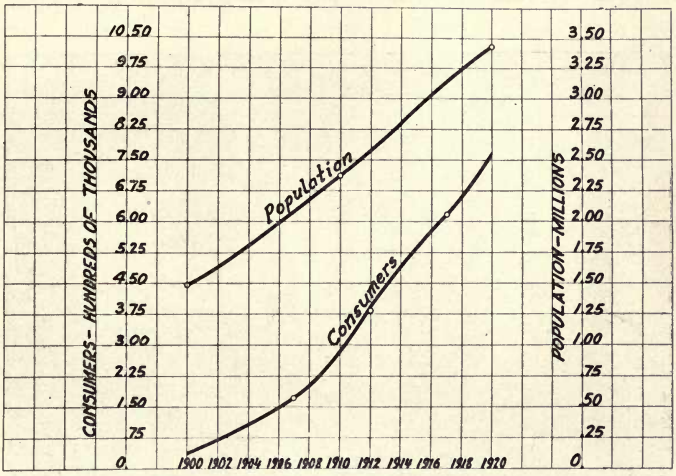
THESE SHOW WHAT 1910 TO 1920 HAS MEANT.

ITEM	TOTAL INCREASE	%
Investment in Electric Power Installations	$509,000,000	181%
Installed H.P. in Central Stations	1,420,000 H.P.	133%
Electricity generated by Public Utilities	5,100,000,000 K.W.hr.	235%
Total number of Homes (Est.)	420,000 homes	28%
Number of Homes Electrified	700,000 homes	140%
Population served	2,075,000	30%
Acres Irrigated (Calif. only)	1,330,000 Acres	52%
Acres Irrigated by Pumping (Calif. only)	1,050,000 Acres	340%
Number of Factories operating	15,700	86%
Persons employed in Factories	335,000	97%
Annual Farm Crops (Est.)	$900,000,000	200%
Annual Production-Manufactures	$2,250,000,000	187%
Annual Mineral Production (Incl. Oil)	$375,000,000	142%
Total Bank Clearings	$16,753,000,000	270%
Assessed Value of All Property	$5,821,000,000	90%

NOTE THE INCREASE WHERE ELECTRICITY HELPS!

The cross section of any community remains practically constant, changing only with the slow modifications of custom which are perceptible only from decade to decade. In other words, to meet the needs of every additional 100 inhabitants in the West, about the same investment in factories, agricultural development, mining activity, etc., must be maintained. These factories, farms and mines must have the electrical power available for their requirements—or they cannot be developed. The story of the basic relationship of electricity to western growth is illustrated by Fig. 46.

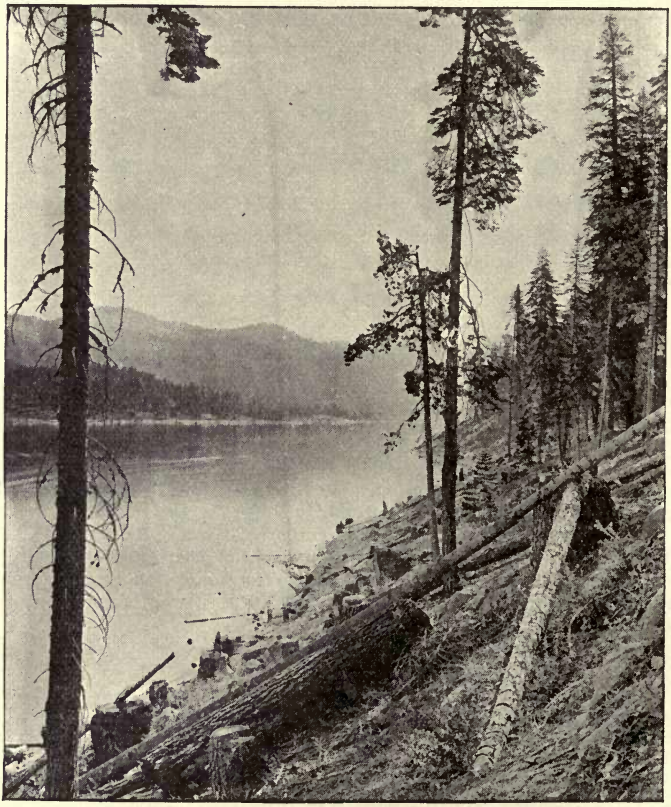
of the state. Let there be a failure to develop for several years, let a power shortage during the summer become the normal thing rather than the unusual thing, and industry and agriculture will stand still. If the use of electric energy has grown at the rate of 10 per cent a year on a sellers' market, and it has for the past four years, can any one doubt that it would make even a better showing if there were to be a buyers' market?



The population of California as shown in Fig. 47, compared to the number of consumers in that state over a twenty-year period, shows that the demand for electricity will not increase in direct ratio to the population, but at a somewhat greater rate, owing to the fact that fewer homes will remain unelectrified and a greater proportion of the farms and factories will use electricity as the electrical idea continues to spread.

The whole matter can be boiled down to this. The market will be here. How about the power? The answer is that the power will be developed if money can be borrowed to build with. The amount needed at the present time is something like $32,000,000 per annum. If costs remain the same it will be larger each year because the growth is compounding and the more expensive plants remain to be built.

Obviously these sums cannot be secured in California alone. It is essential that money from the East be available to supplement what can be raised at home. During the last two years the stocks and bonds of California power companies have found a market sufficient to permit the construction of 400,000 horsepower of new capacity, and they have never been in better standing than they are today—an indication that investors here and elsewhere have confidence that their security is ample and a fair rate of return will be permitted them.



Recreation sites are one of the beneficial by-products of hydro-electric development. A delightful summer resort on Huntington Lake, one of the Southern California Edison Company's projects.

Power Development Requires Adequate Financing

BY WIGGINTON E. CREED

President, Pacific Gas & Electric Company

IN hearing of the industrial future of this state, I am reminded of the great shock I experienced in 1900 on returning from the East. It came from the fact that I had seen the eastern skyline dotted with smoke-stacks, the evidence of industry, and when I reached California I missed those lofty stacks. But when I came back from the East last may I could then with satisfaction compare our skyline with the eastern skyline; I could compare those smoke-stacks in Indiana Harbor, Gary and the other great industrial centers which one can see from the train windows with our great transmission lines which I saw from one end to the other of the state of California. There was brought home to me the great progress that has been made in California as the result of our skyline being filled with steel towers, transmission lines and our great network of distribution lines.

The electrical industry has been working a revolution in California and in the world, a revolution improving our social and our economic position. This general statement will be full of meaning to you when you reflect that here in California the electric energy generated last year, over three billion kilowatt-hours, was the equivalent of the labor of ten million men for one year, and that the cost of that energy was less than one-half of one per cent of a three-dollar-a-day wage. This general statement will mean more to you when you reflect that in the country as a whole electric energy saved the consumption of twenty-five million tons of coal which it would have required seventy thousand men to mine; it will mean more to you when you reflect that we are merely on the threshold of the use of electrical energy in our social life, and in the home.

Electricity is the most efficient power in the world. It is bound not only to strengthen and improve our economic position, but above all to work wonders for the

comfort and convenience and safety of mankind. It seems to me that the electrical industry deserves your confidence as to its ability to carry forward the great work facing us when you consider its accomplishments. The electrical industry from 1902 to the end of 1917 reduced

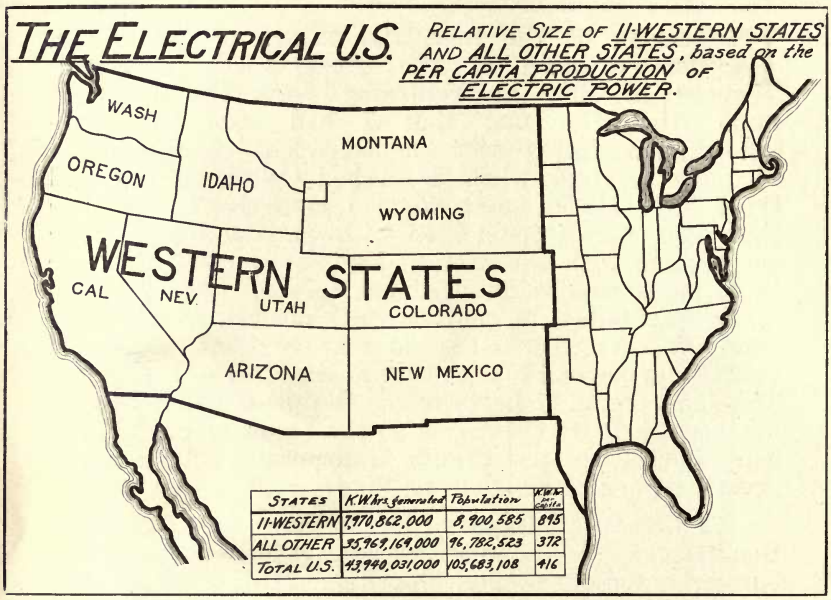


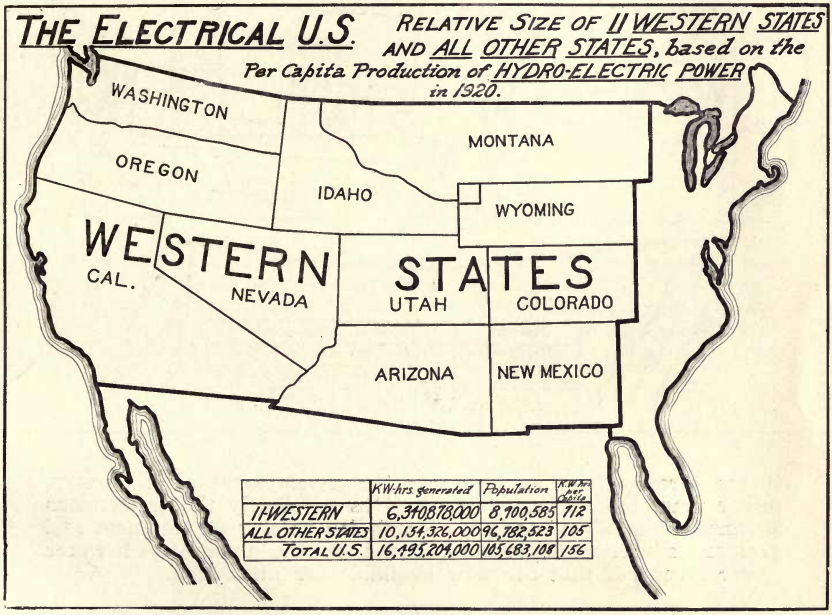
Fig. 48 tells what shape the state divisions of our nation would assume if the respective areas were based on the production of electrical energy per capita. As production is a direct indication of consumption, we quickly see how much more extensively the Westerner uses electric power.

the average cost of electric energy more than one-half what the average cost was in 1902. There was a slight increase in average cost from 1917 to 1920, but the average cost at the end of 1920 was **one-half of what the average cost of electric energy was in 1902.** There is today generated about four times as much electric energy per single employe in the power plant as there was generated in 1902—a great tribute to the ability of our American scientific men and our American engineers.

The position of the electrical industry in the West and the progress which has been made in its development is best shown by pertinent charts.

The first chart, Fig. 48, is that showing the relative size of the eleven Western States and the rest of the country in point of per capita production of electric power. You will notice how far eastward the boundary line of the eleven Western States moves in that comparison.

The next chart, Fig. 49, shows the relative size of the eleven Western States on the basis of the per capita

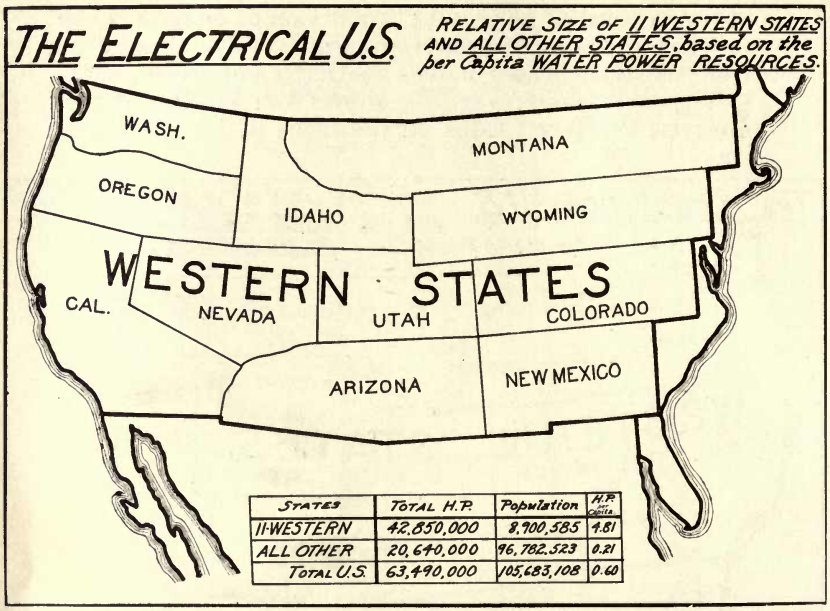


How much greater the Western production of electricity by water power is than that of the rest of the nation, is shown in Fig. 49. Nothing more clearly indicates the progressiveness of the public utilities in utilizing Western power resources.

consumption of hydroelectric power only, eliminating steam power, and again you will see how far eastward the line has moved.

The chart following, Fig. 50, is a most interesting one. It shows the relative size of the eleven Western

States and all other states based on the per capita water power resources and, you will notice, the line moves even farther East. The chart illustrates in a graphic way the point made by Mr. Sibley with his blocks.



It has already been said that in the development of a country, power must come first. Fig. 50 gives us clearly the tremendous advantage the West has in its March for greater development and greater industrial importance, based on the undeveloped water power resources that are now available for utilization.

To some the cost of electricity here in the West looks large because in 1920 the average cost of electricity to each inhabitant in the Western States was three and thirty-four hundredths cents and in all of the other states it was one and eighty-one hundredths cents. You will note, by referring to Fig. 51, the significant fact that in the Western States the number of kilowatt-hours used per capita was eight hundred ninety-five, and in all the other states the number of kilowatt-hours used per capita was only three hundred seventy-two. The difference in cost per capita is due to volume of use.

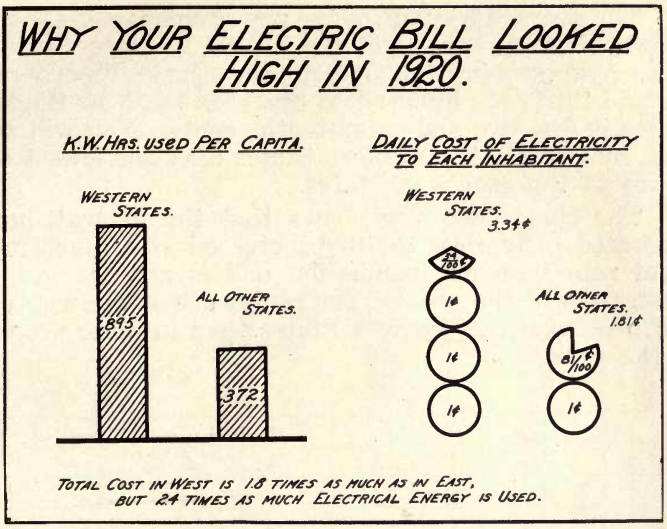
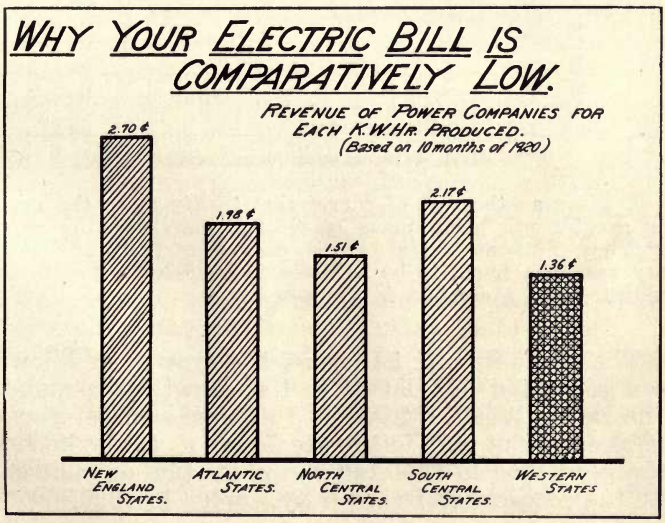


Fig. 51 and 52 forcibly refute any claim that Western power companies are making unjustly large profits. The cost to the average power company consumer of the West per kilowatt-hour is something like ten per cent less than that prevailing in the next lowest district and just about half what the inhabitant of New England must pay for his service.



The average revenue of the power companies for each kilowatt-hour produced in the eleven Western States—these figures being taken from the census report—was one and thirty-six hundredths cents; in the New England States it was two and seven-tenths cents. You will note that, by Fig. 52, the Western States have the lowest cost of any of the groups of states.

The chart following shows that the kilowatt-hours generated from 1900 to 1920 increased at a much more rapid rate than our population and is another graphic illustration of the greater per capita use of electricity in California and the Western States than in other sections of the country.

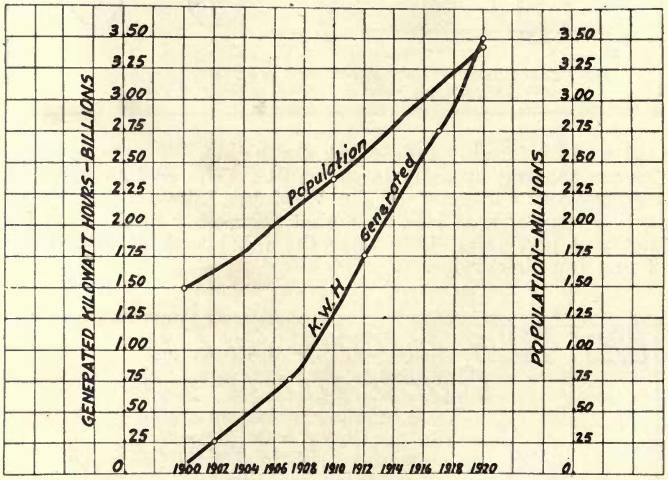


Fig. 53 gives another set of curves that testify as to the increasingly greater use being made of electric power by the average Westerner. Such an increase comes because of the fact that electricity has been found to be an asset in business, a profit maker in industry and a comfort in the home.

The chart in Fig. 54 shows the growth of kilowatt-hours generated in relation to the growth of population in the eleven Western States. I assume some of you will be interested not only in the prediction as to the kilowatt-hours generated in 1930 but the prediction on that chart as to the costume to be worn by women in 1930.

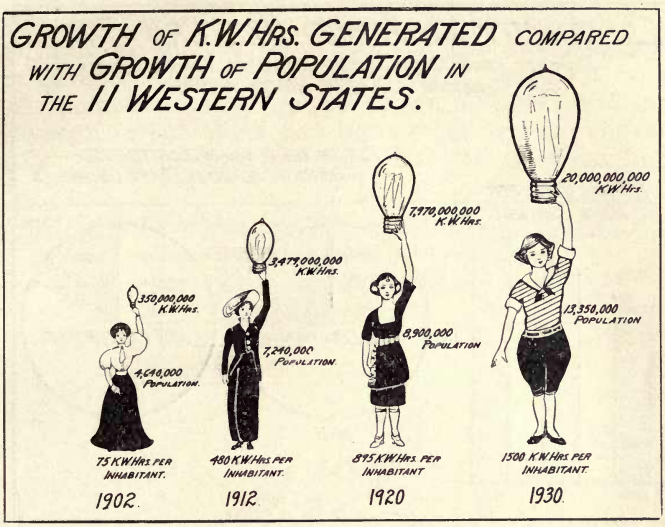


Fig. 54 carries the story of Fig. 53 pictorially into the next ten year period. The size of the woman's figure represents the load of population in the West at the dates specified; the size of the electric lamp represents the total amounts of electric power produced in the West in corresponding years. It is easy to see how much more rapidly the lamp has grown in size than the woman.

The next chart is one of the most significant and interesting charts that I have seen. It gives the percentage of homes electrified in the territory served by the power companies in the eleven Western States. In 1910, 75% of the homes were electrified; in 1920, 83% of the homes were electrified. The figures for the rest of the country are somewhere between 35 and 40% and the consumption of kilowatt-hours used per home served has increased in the West from 1910 to 1920 by almost one hundred kilowatt-hours.

The chart shown in Fig. 56 indicates the certainty of the growth of the electrical industry in the West. The white space from the base line to the dark space represents the amount of hydroelectric power generated and the black space represents steam generated power. You will notice what a steady growth there has been despite earthquakes and fires, financial depressions and other economic adversities. The black spaces in 1917, '18 and

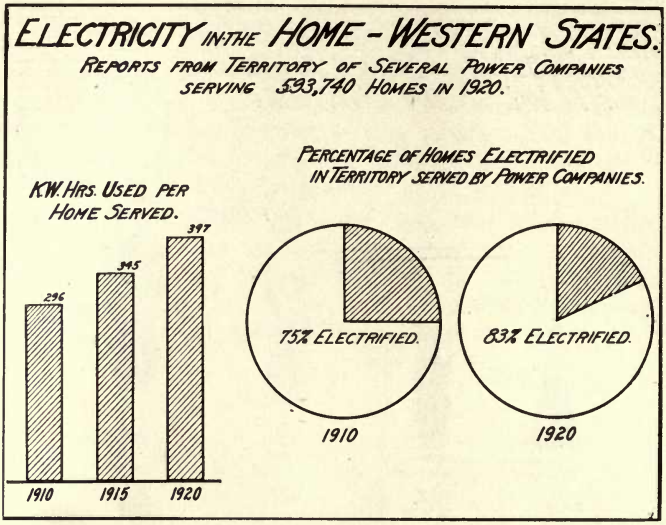
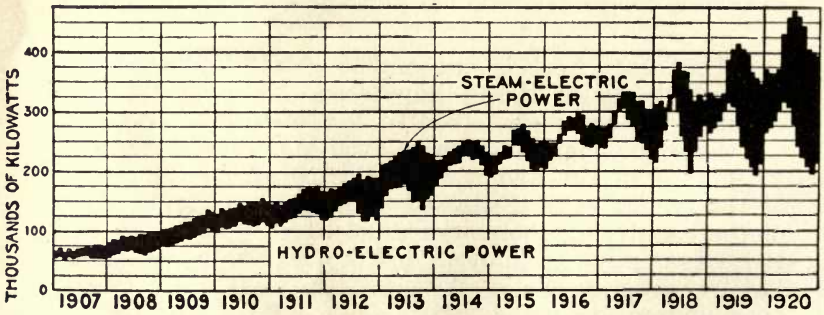


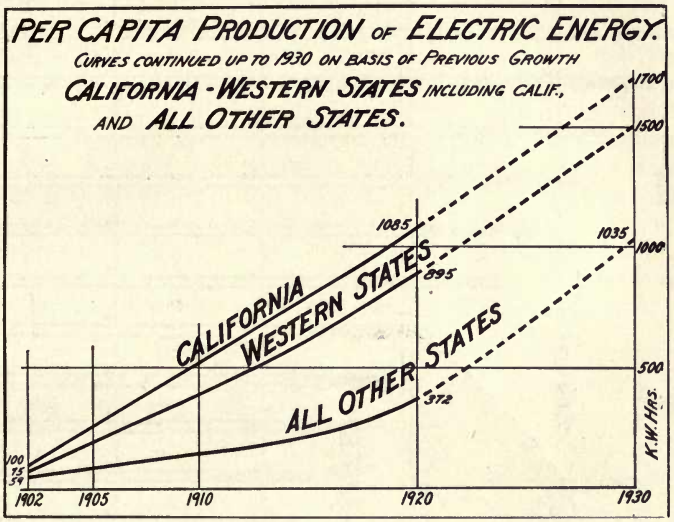
Fig. 55 gives concrete evidence of the previous statements that a greater use is being made of electricity in the home. Notice that the use per home has increased close to forty per cent in the ten years just past. During the same period the number of homes which were not served by electricity has decreased.



The curve shown in Fig. 56 has deep significance to us all in several ways. In the first place it shows how certainly and steadily the demand for electric power has grown in California since the public utilities launched their campaign of greater service to the people. Most important, however, is the necessity which is shown for adequate hydroelectric capacity and definite annual increases. With the supply of fuel oil in more or less uncertainty, it is obvious that an adequate program of hydroelectric power development must be encouraged and safeguarded in every way possible.

'19 are significant. They indicate the effect of our dry years, and, of course, they indicate also the results of under-development of the hydroelectric industry.

A prediction as to the per capita production of electric energy in the West has been made by the chart in Fig. 57. Two factors are used in plotting these lines;



From 1880 to 1920, the Westerner learned to use more electricity in the home and on his city streets, he demanded more goods made in factories electrically operated, he consumed more food from acres electrically irrigated. This increase has been a steady advance, irrespective of hard times or war depressions. Fig. 57 shows how much the per capita production of electric power will be in 1930, if only the present rate of increase is maintained. It is very likely, however, that an even greater increase will be noticed.

first, the growth of population and, second, the growth of the per capita consumption. The growth of the population in the past has been taken and projected. The actual growth in the use per capita of electric energy has been taken and projected. The combination of those two factors shows that from 1920 to 1930 the per capita production of electric energy, based upon the record of the past, will increase from 1085 kw-hr. per capita to 1700 kw-hr. per capita in 1930.

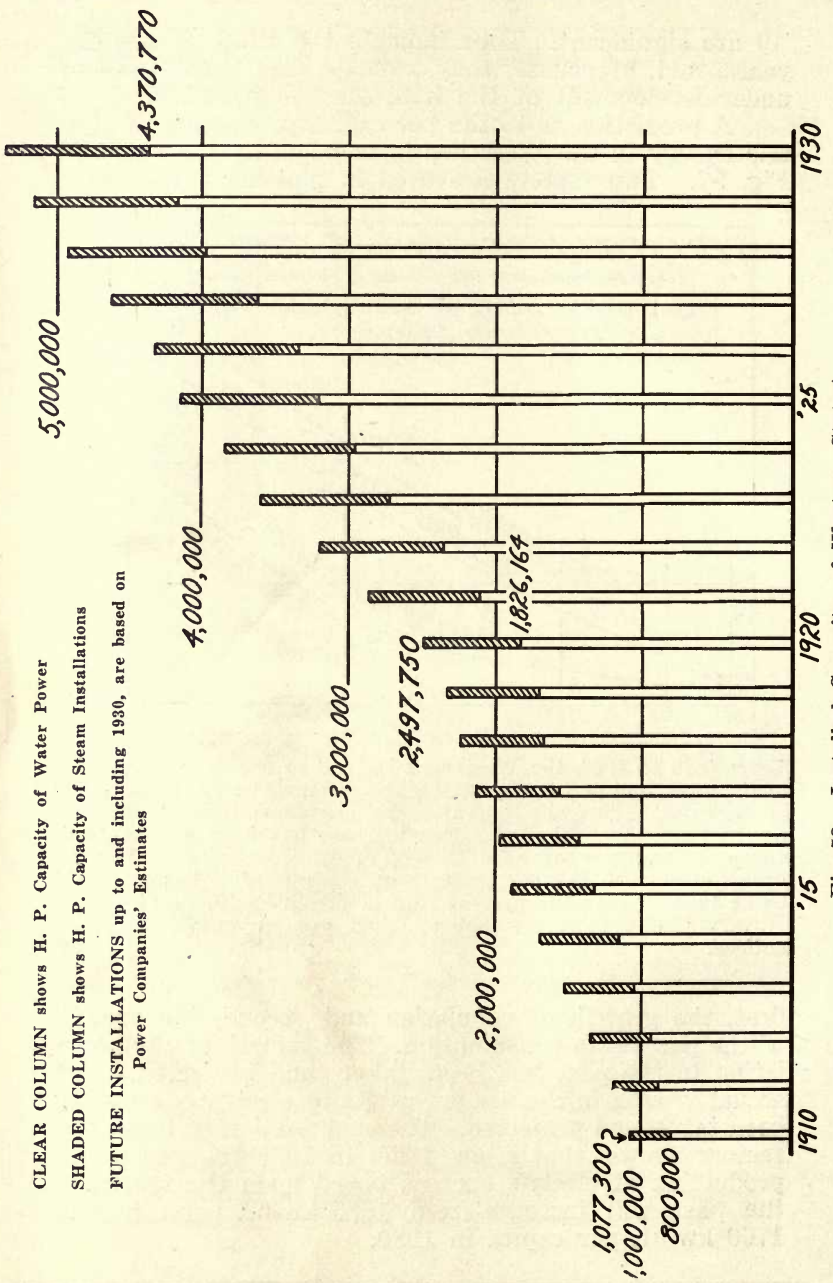


Fig 58. Installed Capacity of Western States

The large chart on page 60 shows the installed capacity of the power companies and the capacity which they will have in 1930. These capacities are based upon a projection of past growth and check in horsepower with the kilowatt-hour chart previously shown.

The chart following that carries forward the power companies' figures and estimates, based upon the record from 1910 to 1920, to show the situation from 1920 to 1930. Taking the period from 1910 to 1920, which is known, as the measure for the next period, 1920 to 1930, you will note that California, Nevada and western Arizona will more than double in the generation of electric power. Nevada and western Arizona are not very important in this computation because in California alone about three billion four hundred million kilowatt-hours were generated. Thus the line for group one may be taken as representing substantially California, and you will note similarity of progress in the eleven Western States.

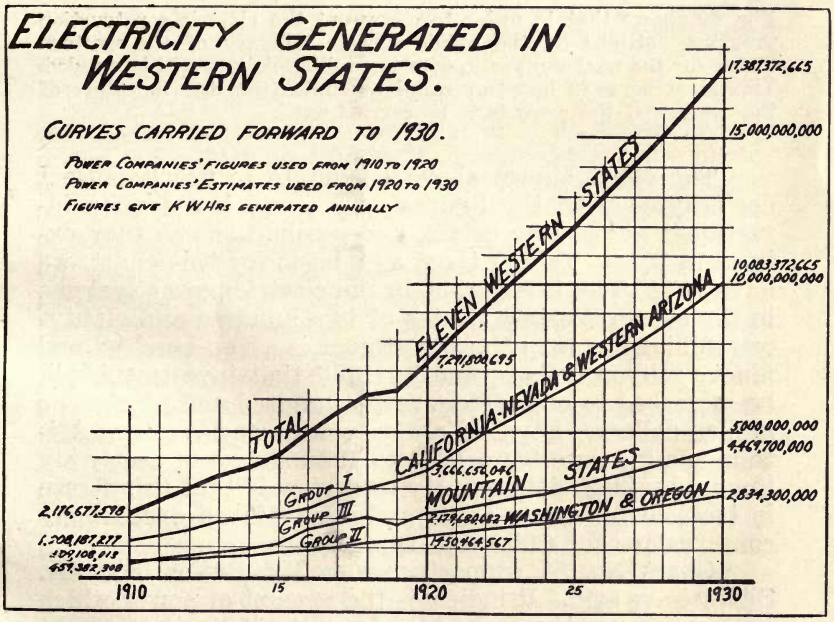


Fig. 59 gives a set of curves supplementary to Fig. 58, in that it shows the actual amount of power generated and the estimated total that will be generated by the capacity shown in Fig. 58.

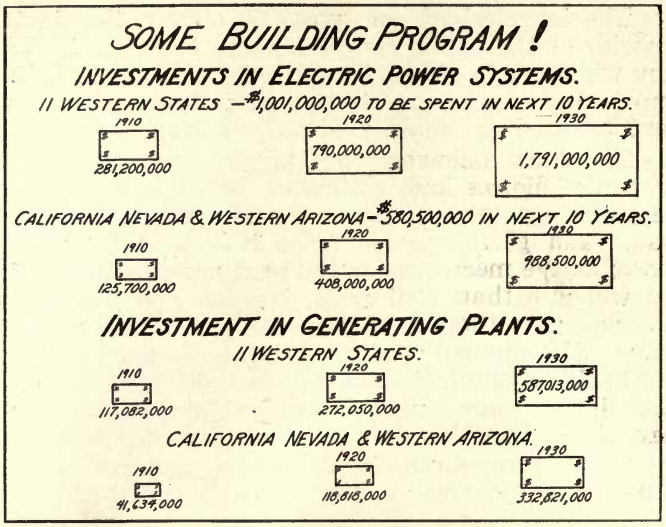
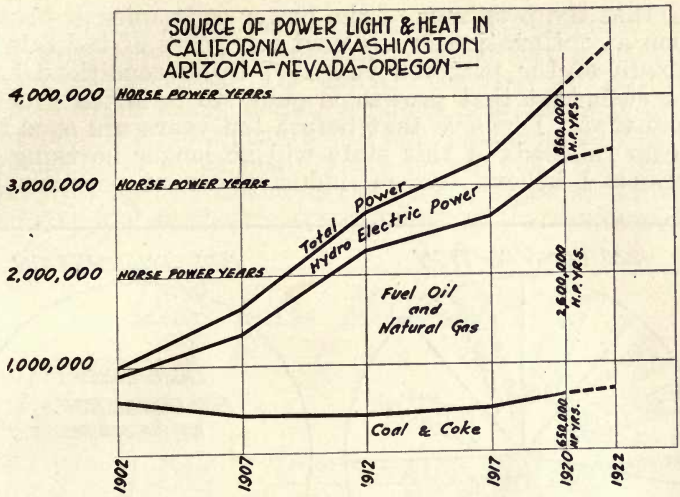


Fig. 60 shows that in order to carry out the electric construction program outlined by the public service industry of the western states for the next ten years, over one billion dollars will be needed. This must come in large or small amounts from the investors of the country if the work is to be carried out.

The chart shown above I hesitate to use because I don't agree with the figures. They are based upon investment at pre-war prices, under conditions as they existed in 1914. Taking them as a basis for this chart, we have in 1910 an investment in the electric power systems in the eleven Western States of two hundred and eighty-one million; in 1820 the investment is seven hundred and ninety million dollars, and by 1930 that investment will be increased to one billion, seven hundred and ninety-one million dollars. For California, Nevada and Western Arizona the increase from 1920 to 1930 shown is nearly six hundred million dollars. My own view is that this figure is too low for those three states and is an exceedingly conservative for California alone.

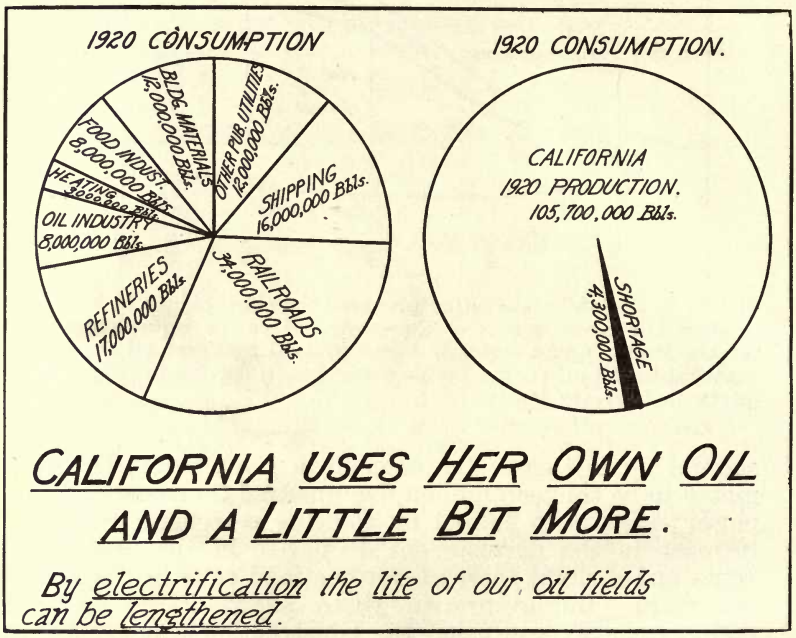
Chart No. 61 supports what Mr. Butler and Mr. Sibley have said. It indicates the amount of power which has come from the coal and coke up to 1920; the amount of power which has come from petroleum up to 1920, and the amount of power which has come from hydroelectric



The U. S. Fuel Administration prepared the chart shown in Fig. 61 to show how small a part of the burden of power, light, and heat for the Pacific Coast states is borne by coal and that oil must be expected to fall off during the next few years, leaving hydroelectric power to bear the burden.

sources up to 1920. The demand in 1930, which is estimated to be thirteen million five hundred thousand horsepower years, is to be met by allowing petroleum a slight increase in the development of power in the next ten years and a slight increase for coal and coke in the next ten years. But even with these slight increases for petroleum, coal and coke, the construction programs of the power companies as now announced are not large enough to meet the estimated demand in 1930. On the basis of this computation, there will be a shortage of one million five hundred thousand horsepower years in 1930 unless a greater burden is thrown upon petroleum, coal and coke, or unless the programs of the power companies are increased. These programs of course are not final. They naturally will synchronize with conditions as they arise, but the chart does significantly call to your attention the conservatism of the programs of these companies and the possibility that there will be even greater demands upon the companies than those that have been outlined. In that connection I cannot refrain from say-

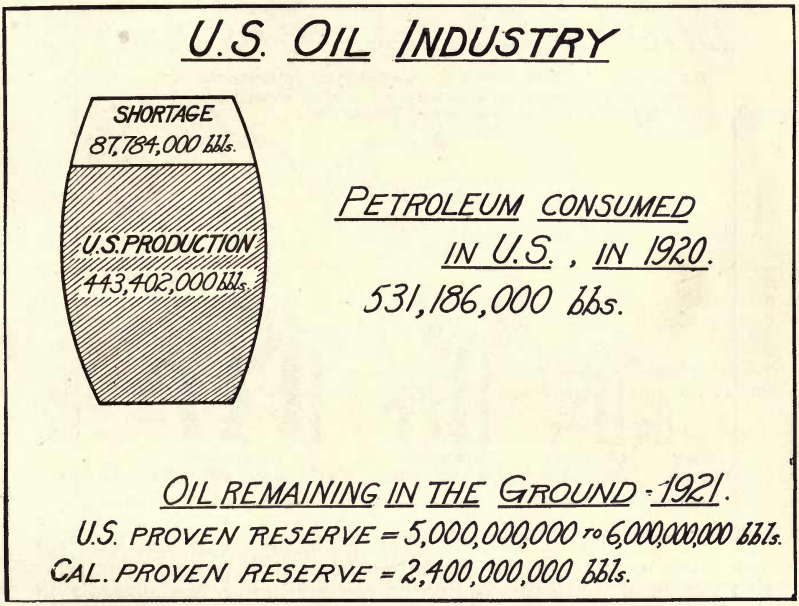
ing that the programs of the power companies are based upon a continuation in the next ten years of the rate of growth of the past ten years. I think conditions here are such that that growth is going to be much greater than that. I believe that before ten years are over the steam railroads of this state will no longer be using oil because I believe the oil industry cannot permanently



References have been already made to the part which oil plays in the generation of electric power in California. Fig. 62 gives graphically the situation regarding oil and its use by various parts of our complex industrial system.

carry the burden of the railroads and all the other burdens which it must carry. Whether it will be electrification or something else I don't know, but I do feel that oil will not be used as the means of power for railroad transportation in another ten years in California. If the burden of railroad transportation is thrown upon the power companies, it means of course that even greater programs must be carried out than are now contemplated.

Over and above the future power for railroads, there are many new uses for electricity which are not factors in the past increase. There are in the state of California today, without any doubt, a billion tons of high grade iron ore. I know that ore will not remain unused in the ground for a great many years longer and I do believe that with the developments that are going on in the steel industry and in the electrical industry, there will event-



Nor can any hope be held out for assistance in supplying oil from points outside of California, as shown by Fig. 63. The shortage throughout the nation is as serious, in relation to the general situation, as is the shortage in California.

ually be built up in California a great steel industry supported by our iron ore and our electric power. If this development comes about, then the programs which we have before us will prove inadequate. This situation does give a justification for the vision of those men who have conceived the Colorado River Project; it does justify the most serious consideration being given to that project and I personally regard the work of those men who have

gone forward to study that project as a great contribution to the future of this state.

You will notice that California is today consuming more oil than it produces; that of the oil produced by California, the railroads are consuming a greater proportion than any other class of consumers.

If we turn to the petroleum consumed in the whole country, we find that the country is consuming more oil

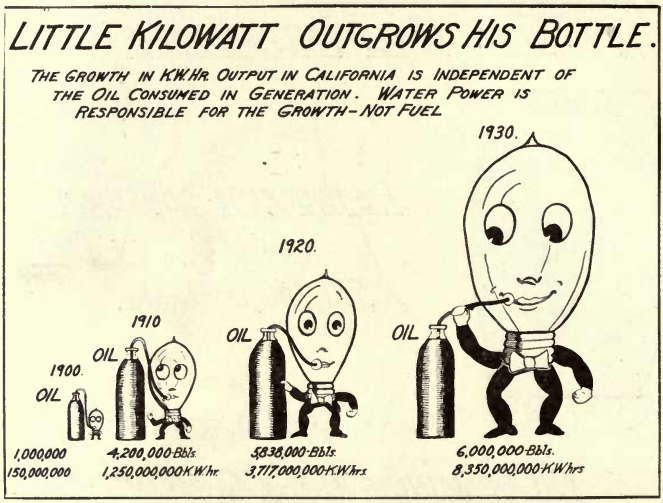


Fig. 64 shows how the public utilities are becoming less and less dependent upon oil in the generation of electric power. The relation of the annual consumption of electric power in California to the amount of oil consumed by the electrical industry in that state is here graphically presented, the area of the child and that of the bottle corresponding relatively to these factors. "Little Kilowatt" has already begun to take to a more concentrated water diet—and is likely to use less and less oil for the future. It is upon water power development that he must depend for his future growth.

than it is producing. The outstanding feature in the oil industry today is that it has assumed or has had thrust upon it, burdens beyond its capacity to carry permanently.

The chart of Fig. 64 shows the growth of the electrical industry in its relation to oil consumed for power. You will notice how much more rapidly the kilowatt-hour

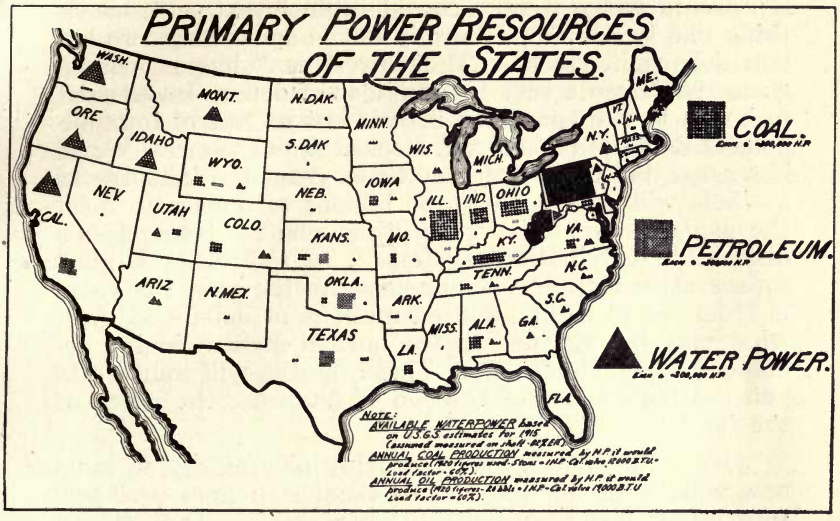


Fig. 65 gives the surest evidence of the growth of the West as an industrial section, as it is here only that inexhaustible power resources are available. Water power will not diminish as the years go by, but will be able to produce more and more electricity because of greater efficiencies which the machinery manufacturers will be able to attain.

output has grown than the consumption of oil. Our dependence on oil must continue to decrease in the future, if we are to have here the adequate supply of power which our civilization demands.

The chart given here shows the primary sources of the United States. The significant feature about it is the depiction of petroleum and coal as power sources for the East, and the unending flow of water for the West. As the sources of power in the East are used up, they will become more and more expensive. The industrial movement, of necessity, therefore, must be westward to the supply of water power.

Now I want to say a few words about financing these construction programs. I am by no means satisfied that the programs outlined are adequate for the next ten years. I am very deeply sensible of the fact that there may come and probably will come new uses for power which will cause the men in the power industry to create new programs of construction. The industry as a whole

represents today a very considerable investment, something like two billion dollars in bonds and nearly two billion dollars in stocks. That investment has grown up since 1902 from a very few millions of dollars investment in bonds to the enormous investment of nearly four billions of dollars in bonds and stocks. The Electrical World has estimated that in the next five years the industry as a whole will need some three billions of dollars to meet the demands for new generating plants, transmission lines and distribution systems. In California a most conservative estimate of our needs in the next ten years is from six to eight hundred millions of dollars to meet what may be regarded as the normal growth in the demand for electric energy. These figures will indicate to you the importance of the job of financing the needs of the industry.

By financing we mean securing new money to build new generating plants, new transmission lines and new substations and new distribution systems. That money cannot come out of the revenues of these companies. It is impossible for it to come out of their revenues. I am astounded every little while to find the notion in men's minds that the companies are financing out of revenues and that they can finance out of revenues. It is an utterly impossible thing. In the first place, the wages of capital must be distributed. Under our system of regulation we are allowed to earn our actual out of pocket costs, depreciation, and, in addition, an interest return upon the capital in the business. Now, the amount allowed for capital must be distributed to capital, just as the wages of labor must be distributed to labor.

It may interest you to know that the Pacific Gas & Electric Company for the year 1920 distributed in wages in round figures, eleven million dollars, and distributed for interest, as the wages of capital, five million dollars in round figures, so that we distributed as the wages of labor, more than twice the amount we distributed as the wages of capital. The wages of capital must be paid or capital will not perform any more than labor will perform if its wages are not paid. As regulation limits our return to the wages of capital, we can not finance out of revenues, and, even if there were no regulations, it would still be impossible to finance out of revenues because it would

be necessary to increase rates very materially in order to secure revenue enough to finance these companies. That is, for every dollar of increased gross revenues which we receive, we must invest in the industry from four to five dollars of new capital. To put it another way: if our gross revenue increases a hundred thousand dollars, it means that we have invested a half a million dollars in

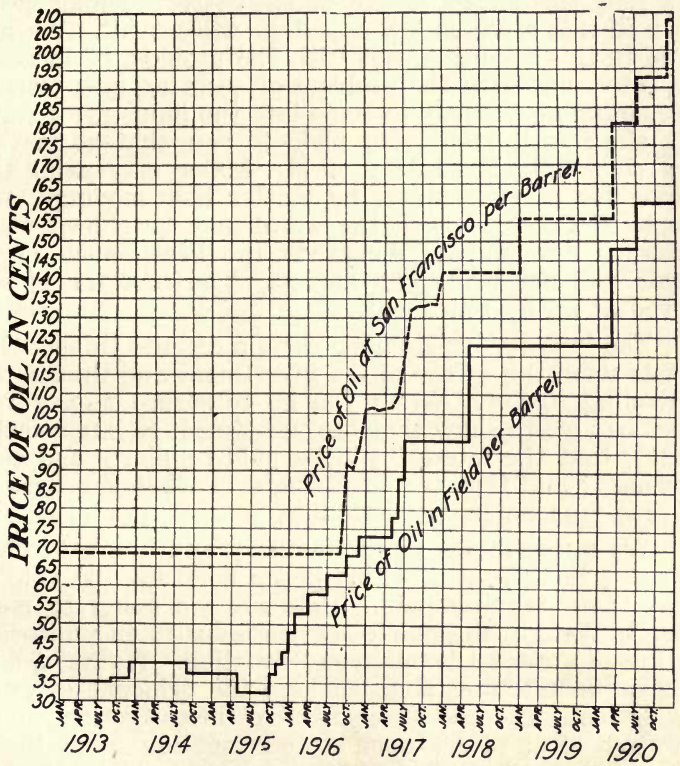


Fig. 66 shows the effect of a shortage on the price of oil. Up until 1915, the possibility of California oil giving out was not given serious consideration. With the rapidly increasing demand of the past few years, however, the oil industry has begun to take count of stock. The result has been a price increase which brought 1920 prices to three times their pre-war level. The improvement in the purchasing value of the dollar over post-war conditions has brought this figure down somewhat, but the slight reduction only serves to show that the increase is an actual one and not a mere feature of the currency inflation.

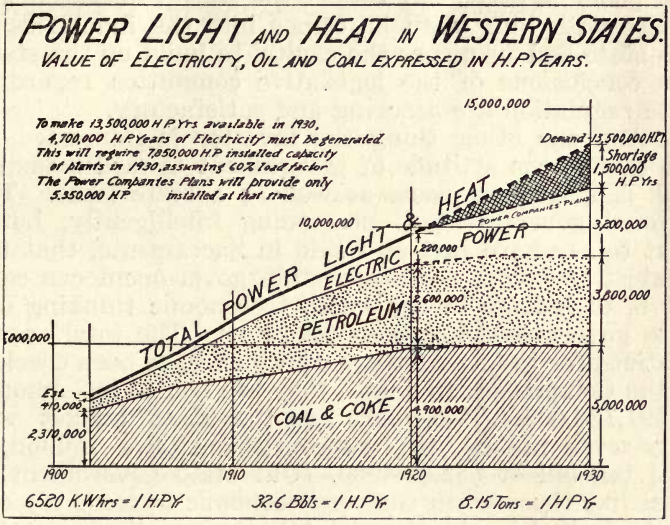
new plants, extensions or what not, in order to get that hundred thousand dollars of revenue. So that to attempt financing out of revenues would throw an economic burden upon consumers which they could not carry.

One of the important factors in the increased consumption of electricity in the West over the eastern sections of the country has been its low cost. The men in this industry recognize the necessity for keeping costs down in this state as low as safety will permit. We are faced in this financing, not with the problem of increasing rates, but with the problem of securing new money, persuading new money to come into the industry. I want to make this thought very plain to you, that no matter how eloquently Mr. Sibley or Mr. Miller may paint the necessities of the future, no matter how movingly the people of California and the world may be shown what electrical development means to the West, such arguments will not bring the money. The investor is not moved at all by sentiment.

The investor insists upon certain definite things. He insists upon the safety of his investment and that is the controlling factor. When you go to secure money you must be able to show that the investment is intrinsically sound; that the interest will be paid regularly and continuously; and that the investment in whatever form it be, has reasonable convertibility.

We must, in our power industry and in every other industry in California which needs financing, be able to meet those requirements. How are we going to meet them? Well, in the public service industry in California we are in a most advantageous situation. We have, as I believe, definitely established here the principle of state regulation. The recent legislative investigation which grew out of an attack upon state regulation seems to me to have resulted in permanently establishing the principle of state regulation in the state of California. If the state of California had run amuck and had gone back to local regulation, the power programs which are now before you would never have been undertaken. They would not have moved forward one minute because local regulation would have destroyed the credit of the companies so far as future developments were concerned. It is a gratifying thing to those of us who have this burden of financing

to know that California seems to be permanently committed to the principle of state-wide regulation by competent experts. We have a greater fortune or as great a fortune in this, that our State Railroad Commission has thought soundly upon this question of regulation. It has not had the conception that it represented solely



The shortage of power which can be expected unless the complete program of hydroelectric development is put through is shown by Fig. 67. By converting annual coal and oil consumption figures of the West into horsepower-years, on the basis of 5 tons of coal or 20 barrels of oil per installed hp., and projecting these curves into the future, it is obvious that even the billion-dollar program of the public service industry for the next ten years is likely to fall short. A sixty per cent load factor is assumed for electric power.

the consumer who wanted a reduction in his bills; nor that it represented solely the company that wanted an increase in its rates. It has seemed to me to have been moved by a sense of its responsibility to the state and the people as a whole, by a consideration and knowledge of the public interest.

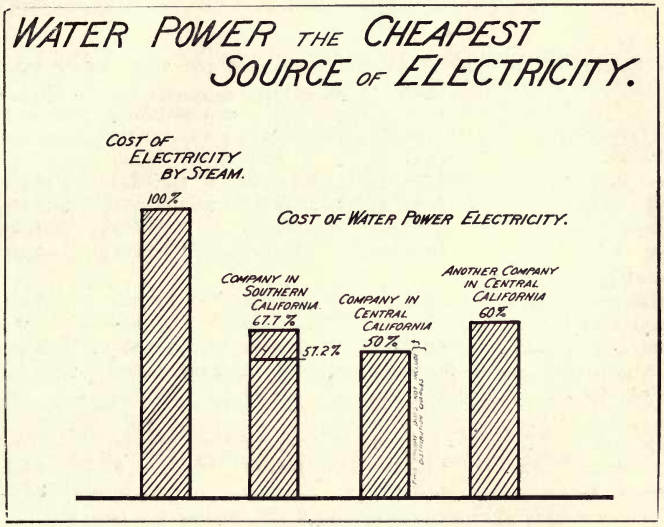
The investor to whom we appeal wants to know what the state policy of regulation is; he wants to know whether his investment is to be permanently protected;

he wants to know whether or not, after he is invited and encouraged to come into the public service industry of California, the policy of protecting his investment will continue. The result of the legislative investigation has great significance in financing the power companies. The investor is not going to come in unless he believes our past policy is permanent,—that the state will be fair and square with him when he comes into the industries of this state and furnishes the capital to build up the state. The conclusions of the legislative committee regarding state regulation are assuring and satisfactory.

And one other thing the investor is interested in, and that is the attitude of government toward industry. This is a national issue as well as a state issue. The national government is proceeding intelligently, but I want to say here just as I said in Sacramento, that the greatest economic crime any state government can commit is to indulge in the kind of economic thinking our state government has been following. The total appropriations for the next two years which have been checked by the Comptroller to date,—they are not all in—amount to $91,120,000. Two years ago the state budget was forty-seven million, the appropriations five million, a total tax bill of $52,000,000. Our state government in times like these when the very economic heavens cry out not to do it, has sanctioned total appropriations of more than ninety-one million dollars for the next two years. The estimated revenue available for the same period is eighty-three million dollars plus an accumulated surplus of six million dollars, so that there is a constructive deficit of a little over two million dollars today. This thing has been done, ladies and gentlemen, at a time when economy is being practiced by every sound, sane thinking man in the state of California. I make no apology for criticising. I am not in politics and no company I am connected with ever will be in politics, but I will continue to assert and exercise my right to say what I think of that sort of public policy and to tell the people of this state the economic crime committed against them by that sort of governmental action.

Finally, I want to leave with you just this thought: that we must realize here in California how inter-related we are in all our pursuits; we must realize that whatever helps agriculture, is helping industry; that whatever

helps industry is helping banking, etc. We must above all realize that in the vanguard of our development must go not only the power companies, but all the public service companies, because it is an economic fact that our general development cannot exceed the development of



The natural result of an increasing price of crude oil for fuel is an increase in the cost of electric power generated by steam driven machines. With water power, however, little increase will take place in the cost of electricity generated by hydraulically driven machines. In the old days of cheap oil, the initial cost of a water power plant was so much greater than that of a steam plant that it was often found more economical to pay for fuel than to pay the interest on the larger investment. That day has passed, as is clearly shown by the estimates of comparative cost submitted by California companies. Water power is the fuel of the future, as Fig. 68 shows.

the public service industry. You can have in the banks all the money that you can conceive of, you can have all the credit facilities that you can conceive of, but if your public service industry is under-developed and unprepared to meet the public need, growth will be stifled. This conception of the public service industry as the vanguard of growth and development must be brought home to our people. They must see that great economic truth; they

must understand it and they must feel it, and we on our part in the business must deserve the cooperation which we ask. We must be like a university president; we must have a great deal of faith and we must have a great deal of patience—faith that our educational work will bear results, patience to await those results.

THE ELECTRIC PUBLIC SERVICE INDUSTRY OF THE WEST IN 1920

	Calif.	Northwest	Intermountain and Southwest	*Estimate 11 Western States
Total investment	$567,102,093	$248,525,642	$360,842,453	$1,318,000,000
Employes	21,178	5,909	3,840	34,200
Annual payroll	$ 28,293,964	$ 10,005,740	$ 5,680,396	$ 48,300,000
Annual taxes	$ 5,035,631	$ 2,155,595	$ 2,242,771	$ 10,200,000
No. consumers	780,691	323,895	255,366	1,485,000
Connected load, hp.	2,603,682	986,847	1,217,244	5,330,000
Installed capacity, hp.				
Water power plants	783,727	449,000	591,000	1,861,000
Steam plants	422,683	138,000	111,000	759,900
Total	1,206,410	585,000	702,000	2,515,000
Kw-hr. generated	3,648,955,316	1,450,463,882	2,194,680,082	7,970,862,000
Miles of wire	116,585	39,769	50,300	226,000
Fuels used:				
Coal—tons	0	43,472	224,299	706,419
Oil—bbl.	4,991,599	166,779	0	6,339,574
Gas—cu. ft.	2,800,000	.....	.....	3,042,007

*Based on U. S. Geological Survey Figures for 1920.

Outstanding Features of the National Situation

BY R. H. BALLARD

Vice-President and General Manager, Southern California Edison Company

BEFORE reviewing the story of western development, I thought it would be easy to speak on the subject assigned to me on this program, but as I sat here through such a wonderful program I heard my National features all explained by the preceding speakers. I am forced, therefore, to the conclusion that there isn't much nationally by way of principle that is not already under way here in California.

One of the features of the recent N. E. L. A. Convention was presented by Mr. Samuel Insull of Chicago, and it was the subject of building large central generating stations and inter-connecting transmission lines. There was shown a very considerable inter-connected system all through the Mississippi Valley, but reference was made in very flattering terms to the inter-connections on the Pacific Coast.

Then was taken up the question of the proposed superpower system on the Atlantic Coast. During the discussion it developed that the only thing new concerning this superpower system was its name. It developed that morning when the general subject of large generating stations and inter-connected systems was under discussion, that the business that we are now engaged in has grown to such a point and advanced in an engineering way to such a degree, that we are forced way beyond the boundaries of municipalities, of companies and of states themselves; that the economic situation demands that these systems traverse the country just in the same manner as the transcontinental railroads do. With the advance in electrical transmission at higher and higher voltages and at longer and longer distances, we can visualize transmission systems several times the length and size of those now existent in California. There was also developed the point that in some of the Eastern sections of the country the laws are so inadequate as to prohibit the transmission of electric energy from one state

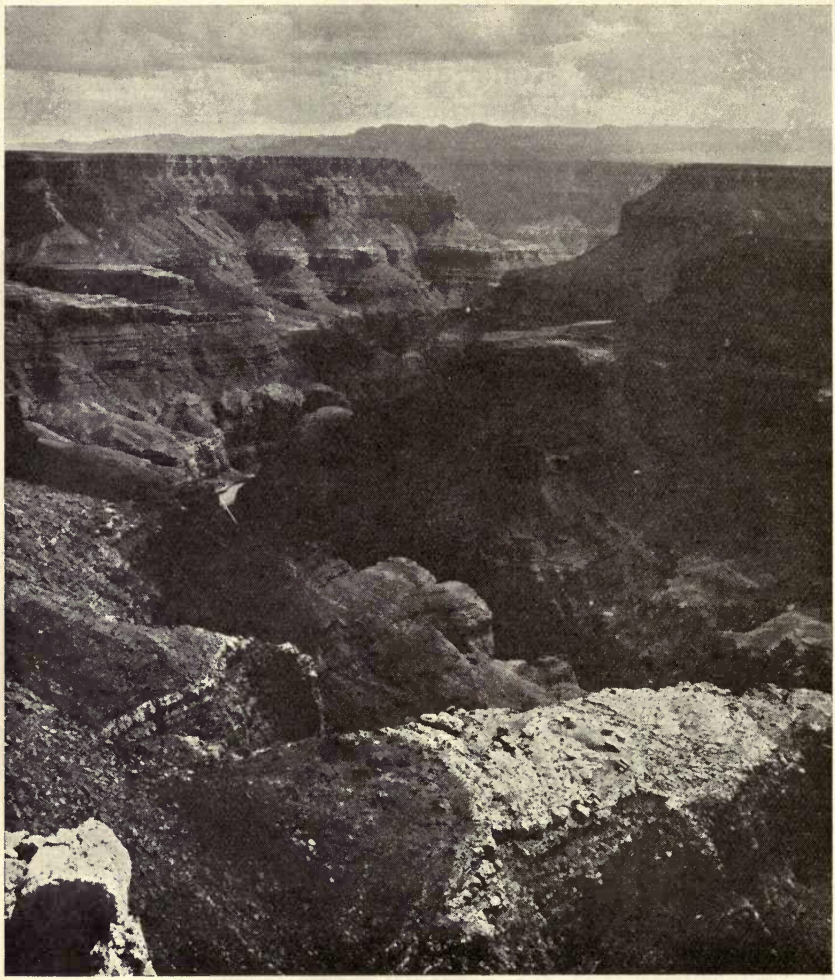


Fig. 69. — Marble Canyon Damsite on the Colorado River where the Southern California Edison Comany proposes to build a 500-foot dam which will impound forty million acre-feet of water in an artificial lake over two hundred miles in length, with a possible development of two and one-half million horsepower. The project outlined by the Southern California Edison Company in its application now before the Federal Water Power Board, suggests the carrying out of this great undertaking as a cooperative enterprise, together with such other power companies as may wish to participate, construction work to be done at cost under supervision of the government, with the interests of flood control, irrigation and power needs alike conserved.

to another and it is for that reason more than any other that the great superpower scheme has been evolved. One of the first things they must do is to have some changes in those laws. We were told there that that is the only reason why any governmental assistance has been asked for the superpower plan, which was definitely outlined as a plan for private ownership under state and public regulation.

We have a lot of power yet to develop in California if we are going to keep pace with even the normal demand which has been outlined here today. The plan for the development of the Colorado River in addition to and supplementing the development within the state of California, seems to me to be directly in line with that fundamental principle or outstanding feature to which I have referred and which was discussed at Chicago. The Colorado River power will create a reservoir holding some forty million acre feet of water. Mr. Sibley referred to the largest reservoir in the world in one of his charts at present existent, some three and a half million acre feet. The Colorado River storage reservoir, therefore, will be ten times as great as that largest reservoir referred to, which was to take a million men drinking a quart of water a day the time since Noah to consume. It would take ten million people performing the same service over the same length of time to drain the Colorado reservoir.

In the matter of oil consumption the power which may be developed from the Colorado River will substitute for ninety million barrels annually and that very closely approximates the total oil production of the entire state of California. Incident to the development, water may be placed upon some two and a half million additional acres of land which now are practically desert and non-productive and some three hundred miles of river will be made navigable. We could go on counting up and up the increased values and economic wealth, but the more we say about it the more we all realize that it is a project which will require the most earnest cooperation, support and enthusiasm of every company in California and in the six other states involved, as well as that of every man and woman in our industry and the people at large.

Another feature touched on at Chicago was the matter of finance and the question of selling stock. It was re-

ported there that a canvass of some forty companies in the United States showed a little over a billion shares of stock to have been sold to the public so far. The number of stockholder consumers now reported by those forty companies in the United States was about one and a half per cent as compared with population served. I know you will all be glad to learn that the credit for the starting of this stock selling plan of interesting the public in the territories served directly as partners, was credited to the Pacific Gas & Electric of San Francisco, as they were the

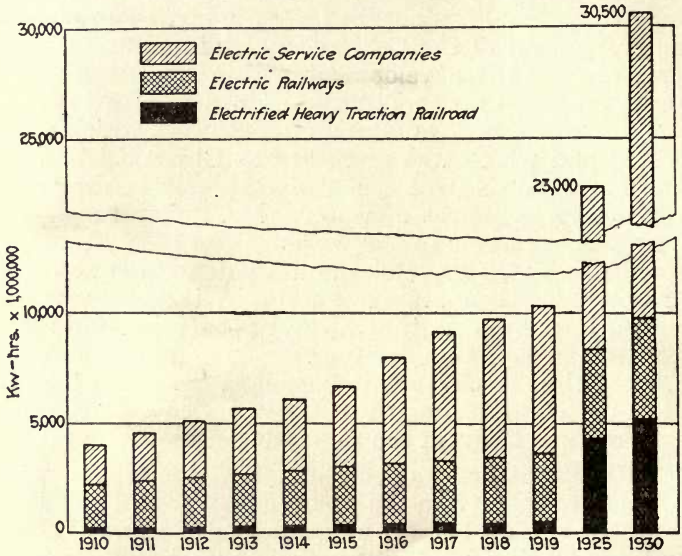


Fig. 70.—Past and Future Estimated Growth of Energy in the Atlantic Super-power Zone.

first Company in the United States, or for that matter in the world, to start the plan.

Another feature brought out was that of cooperation within the industry and cooperation of the industry as a collective unit and as individuals with the general public.

I predict, because of the work that has been done in California along this line, that within a very few years no one connected with the electrical industry anywhere in the United States will feel that he is really in the industry unless he is honestly and earnestly cooperating with every other member or branch of it.

Why Every Citizen is Interested

BY A. EMORY WISHON

General Manager, San Joaquin Light and Power Corporation

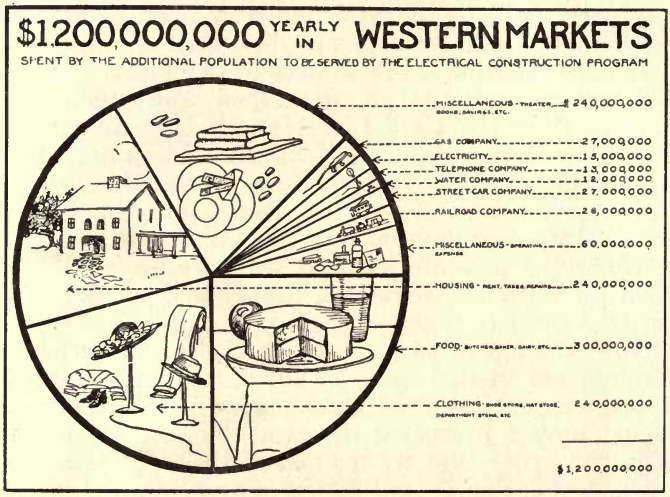
WE electrical men are in the electrical industry because it is our industry and we are proud of it, because it is probably the greatest industry in the world today and it is the basic industry upon which every other industry and development depends.

Let me mention a few figures at the start. There is 64,800,000 horsepower of developed and undeveloped water power in the United States. Of that amount, the estimate for California varies from six million horsepower to nine million horsepower and I am optimistic enough to call it nine million. There has been approximately one million horsepower developed in this state so that we have nine times the possibilities that we have already accomplished for all lands, minerals, timber and in fact everyhting that goes to make a great industrial West.

Now, the electrical industry in California anticipates a development in that state of seven million horsepower, and development requires financing. In order to finance we must have a protected investment and a fair rate of return. In order that we may have these we must have fearless legislation. Legislation represents the opinion of the voter, and properly should. Therefore I say to you that the greatest problem that faces the electrical industry today is the problem of having the public understand what the electrical industry is doing for the individual and for the public in general.

What part does electricity play in our everyday life? Picture the world of today and then take from that world the electrical development of the last thirty years—what have you left? A world without adequate communication, without adequate transportation, without electric light or power—a world without possibilities. Our industry is that great electrical industry which has made the world of today possible and upon which communication, transportation, light, heat, and power depend. The trouble is that the average citizen does not appreciate or understand these facts. He does not understand the language we

speak, the electrical terms, or the details of our business, and the fact that ours is the basic industry must be driven home to him, as we have tried to drive it home here today, in the terms of what our development means to him in dollars and cents. We must show him that when our business suffers his business suffers and when we fail to develop he will fail to develop. When he understands that he is affected we will have legislation that will make the necessary development possible.

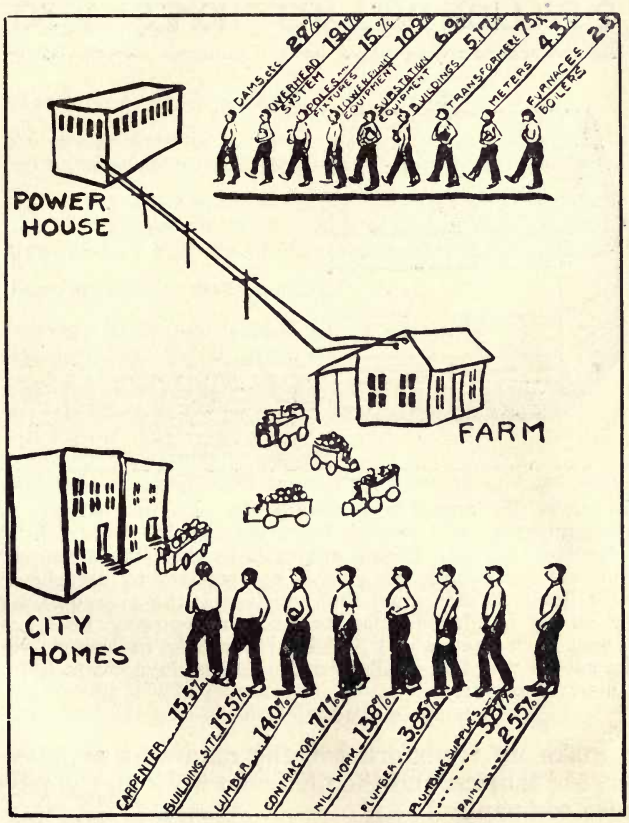


It is estimated that over two and a half million people will be added to the population of the West by 1930. This means that western industries and western agriculture must have grown sufficiently to support this number of additional people by that time. It is obvious that the plans for electrical development must go forward at the same time to make this growth possible. What the money spent by these 2,600,000 inhabitants will mean to western merchants is presented in Fig. 71, counting $1500 as the average income for a family of three persons.

We who study the problems affecting the development of the West know that the West can not develop ahead of her hydroelectric resources. If more factories are to be built in the West more power must be available; if farm lands are to be developed and agriculture extended, there must be more power; and any individual or political party that delays such development delays the

development of the state of California. This means a delay in the different lines of industry, a loss in payrolls and a loss in income to every business in the state of California. To get that story over is the biggest problem before the electrical industry today.

California contemplates a program of hydroelectric construction which will amount to one billion dollars in



Though the billion dollars which will be required for the present building program of the public utilities selling electrical service will largely come from outside the state, much of it will be spent in the state. Fig. 72 shows pictorially the percentages of this huge sum which the various elements of our commercial life will receive.

the next ten years. Let's see where that billion dollars goes to. One billion dollars in actual power equipment! I can not quote figures offhand but I do remember that 7 per cent of that total one billion dollars will be expended for transformers, and, I ask you, how can we enlist the help of the man who makes transformers? How can we enlist the help of the man who handles the materials that

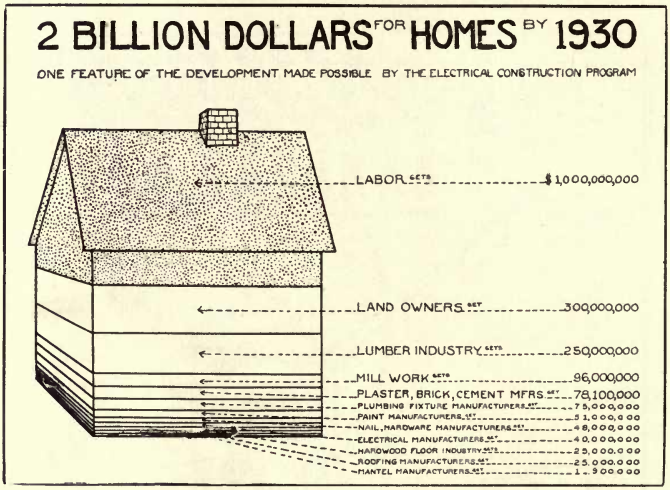


Fig. 73 shows the amounts of money the various elements of our social organization will receive from the two billion which will be spent for homes. Two homes are built in the city to support the needs of one farm made possible in the country by electric irrigation. Similarly 20 men must find housing on the average for every factory which is placed upon the power company lines. These homes will each need about 400 kw-hr. yearly in electric service, and the people who live in them will need employment in industries using electric power.

go to make up transformers, the man who supplies the copper, the fabrics, and the men who work on the payrolls of those companies?

I have spoken of the program for the expenditure of a billion dollars for hydroelectric development to be spent largely in the state of California, but the greatest thing of interest is what that billion dollars does in other lines of development. For instance, figuring on the basis of our actual census, that is the homes on the basis of

population, we find that by extending the present curve to 1930 the West will need two billion dollars to be spent in homes. We find upon further analysis that in the average home 47% of the cost goes to labor, and 53% for material. The lumber interests alone will receive 14% of this two billion dollars. Is the lumberman interested in electrical development—in legislation that will make possible electrical development? Is the carpenter trade that

60,000 customers served;

the employment of 1,300 people in the electrical industry with salaries paid to them of $2,000,000 annually;

the use of 9,000 miles of wire,
and the investment of $37,500,000 in generating plants, transmission and distribution equipment.

The furnishing of electricity:

for the electrification of 25,000 new homes,
thus serving 100,000 persons;

the operation of 240 miles of electric railways,
representing $27,600,000 of investment,
employing 1,200 persons,
carrying 45,000,000 passengers,
and spending $1,375,000 annually as operating expenses;

and for

the operation of mines and reduction plants,
producing $18,000,000 of minerals annually,
employing 4,000 miners;

the operation of 1,300 factories,
representing $100,000,000 of investment,
employing 27,000 persons,
and producing $140,000,000 worth of goods annually;

the irrigation of 125,000 acres of land,
resulting in the expenditure of $6,250,000 for improvements,
producing annually $9,500,000 worth of crops,
and employing 5,000 farmers and laborers.

Fig. 74.—What 100,000 hp. installed in hydroelectric power plants means.

receives 15.5% of two billion dollars interested in electrical development? Is electrical development then entirely the problem of the electrical industry, or is it a problem that affects every individual?

Fig. 74 shows exactly what one hundred thousand horsepower installed in hydroelectric plants, or one-tenth

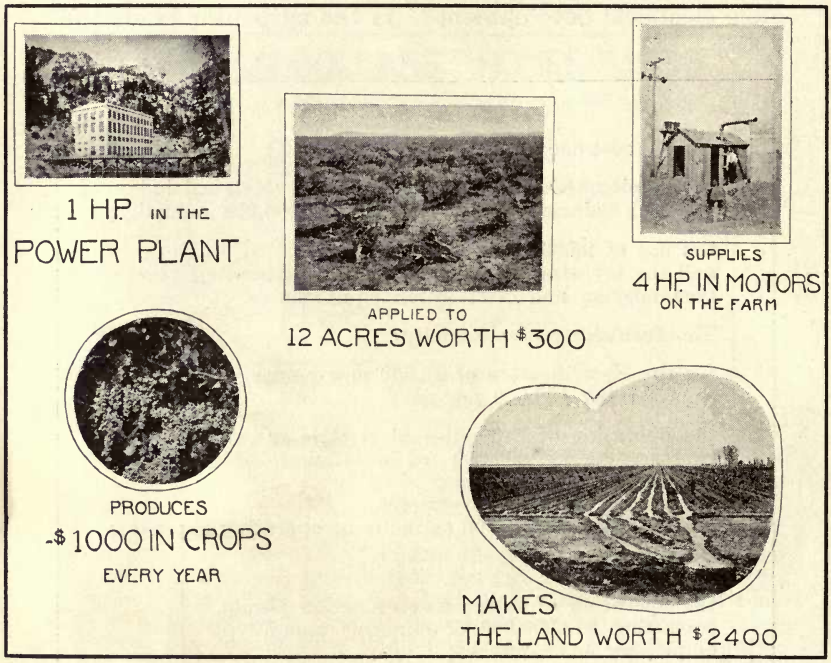


Fig. 75 gives figures that were obtained from government reports. Think what it will mean in increased land value, crop returns and additional employment, when electric power makes possible the cultivation of these thousands of additional acres of land—land that is now lying idle and unproductive.

of our proposed development, will mean in other lines of industrial development. This is the same hundred thousand horsepower working all the way through. It does not mean a hundred thousand horsepower for each segregation of this chart, but the same hundred thousand horsepower which accomplishes all of these things.

The chart on page 84 will give you some idea of what one horsepower installed in generating capacity in the

mountains means to the farmer. That one horsepower will take care of four horsepower in motors on the farm. This may be considered as an average for the West taken over a length of time and is possible because the motors do not all work at the same time. This one horsepower applied to twelve acres worth $300, makes that land worth $2400, and enables it to produce $1000 in crops each year.

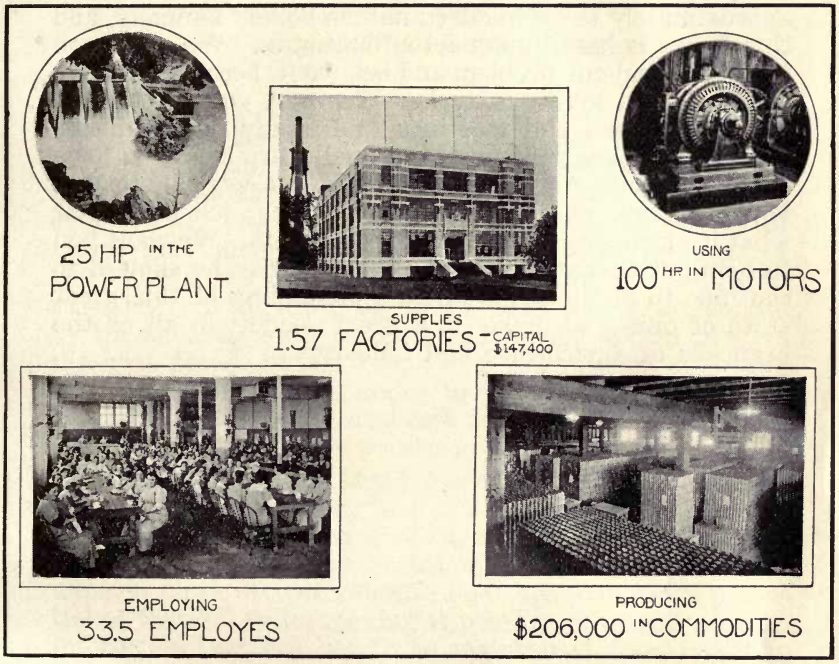


Fig. 76 is a complementary one to Fig. 75, in that it shows the results of added industrial activity as more electric power becomes available.

The next chart will show you what one horsepower of generating capacity installed in the mountains means to the industrial phase of our life. Twenty-five horsepower at the plant in the mountains supplies one hundred horsepower in motors installed in 1.57 factories. With a capital investment of $147,000 these factories supply work for 33.5 employes and produce $206,000 in commodities annually.

Carry this thought home with you—our problem is your problem. Our development means your development and the development of your business. It means increased payrolls; it means more work for the laboring man of all classes and trades in the state of California. Remember also that the politician or political party that stops hydroelectric development for one year penalizes the people of the state of California to the extent of approximately three hundred million dollars annually, and this figure is based upon actual statistics. We want you to understand our problem and believe it, because we have the facts and invite analysis. We want you to come to our conventions and meetings and study our problems because they are your problems, and every time you have the opportunity we want you to tell the electrical story to your employes all the way down the line; tell them just what it means to them in dollars and cents. We want you to help put this story over so that we may be allowed to continue to play our part in the upbuilding of this great state of ours; to make it a great leader in all of the branches of agriculture and industry.

Report of Public Policy Committee, Pacific Coast Electrical Association

Del Monte, June 10, 1921

BY JOHN A. BRITTON

Vice-President and General Manager,
Pacific Gas and Electric Company, Chairman

WITH the close of the war and normal conditions, confidence was established for the Pacific Coast States, and with a certainty of their future, capital has been obtainable for the construction and development of the water powers of these states, and it is worthy of notice that during the past year a total of upwards of 100,000 hp. has been added to the plants theretofore in existence. With the program of development announced by the several power companies, it would appear as if in the next decade at lest 100,000 hp. per annum, or a total of 100,000 hp., will be added to the hydroelectric power resources of this state, at a cost for generating plants and distribution systems in excess of $500,000,000.

Great strides are being made, as have been made in the past, in overcoming the difficulties of long distance transmission. Pioneering always in the field of electric endeavor, Pacific Coast States again promise to set the unusual mark of transmission lines operating at a potential of 220,000 volts, making it possible eventually for an interconnecting bus bar to be maintained from north to south, so that a chain of power houses, finding their energy from the eternal snows of the Sierras, may equalize the matter of demand as well as the matter of shifting the load as between the different parts of the state.

Already the interconnected systems of this Pacific Coast permit of the transmission of energy from the Oregon line to the Imperial Valley, returning in a northerly direction from the Imperial Valley to the state of Nevada, and while not in a position to take care of or insure supply to meet conditions in all parts of the state, is in fact a reality that paves the way for a more perfect interconnection that is certain to result in the future.

Perhaps the most important thing that has happened since the war period, has been the recognition by the public utilities of the necessity for better public relations. That note is sounded wherever men in the public utility industry gather for conference; the necessity for it is urged by all regulatory bodies; it is now the slogan of the press, and the far-seeing and wise executive takes public relations as his text and preaches that gospel not only to his employes but to the public whenever opportunity affords. As a matter of fact, executives of all companies, leaders in public thought, and newspapers of reputation and prominence are speaking and writing daily Public Policy Committee reports to the people of the whole United States. The Public Policy Committee report of this Section is therefore largely made up of excerpts from those executives who, having in mind the welfare of their companies and of their consumers as well, have from time to time given utterance to their views on this subject.

Mr. A. B. West, vice-president and general manager of the Southern Sierras Power Company, says:

"I feel that in a large part our principal problem can be stated in three words—better public relations. In every community there exists, and probably always will exist, some two or three elements which are seeking to drive out of business—yes, to destroy—the public service corporation.

"On the whole, however, this section is made up of honest men, and our problem is to get before these people the facts."

Mr. John D. McKee, president of the California Oregon Power Company, expresses himself as follows:

"No opportunity should be overlooked of presenting to the public the truth regarding the utility, emphasizing especially the financial, physical and engineering problems, which have to be met and overcome. The company can give the most efficient service only if it receives the right kind of support from the community of its users. Conversely, business activities of the community cannot develop and prosper to the best advantage unless they enjoy the benefits of good service. It is to the mutual interest of the company and the public that the company give the best possible service and that the public help it to do so."

Mr. W. E. Creed, president of the Pacific Gas and Electric Company, says:

"The public service industry as a whole should adopt the policy of frankness. Many companies have done so, but the others should follow. Suspicion feeds upon concealment. Most of the distrust of the industries arises from things imagined and not from things known. To the extent that an industry follows these policies it will find an improvement in its public relations and increasing cooperation from the public."

In this matter of public relation there can be no successful issue or no consummation of the heartiest desire of those who have the direct interest of the companies at heart, unless the mass of employes of an organization becomes imbued with the thoughts and ideas of public relation and public service so thoroughly, that they are directly the mouth-pieces of the management in all their relations with the public. The aim of all departmental heads should be to bring about the initiative and thought of a man, and to encourage him, not alone with promises but with an actual demonstration by recognition in better position or compensation of his worth to the public utility and the public which he thereby serves.

The following editorial from Collier's of March 12th, 1921, bears directly on the point:

"Of all the bills that come to you on the first of the month, which do you pay least willingly? Are not the two that excite the most distrust the gas bill and the electric light bill?

"There is an explanation, somewhere, of the lack of good will shown by the average community toward the public utility company that serves it with light, heat and power. One reason, we think, has never been fully stated: If the power and light companies were owned and controlled by one or two men, and named after people, as the majority of our big enterprises are, we would be apt to have a more friendly feeling toward them.

"If you received your electric-light statement from the 'Smith & Jones Electric Light Company,' and you thought it too big, you could go down to see Mr. Smith or Mr. Jones and feel that you had talked to headquarters. Perhaps Mr. Smith or Mr. Jones would be neighbors of yours. Perhaps their wives would know yours, or their

children would go to school with yours. They might belong to your club, or fish in the same lake, or shoot over the same marsh, or drive the same kind of automobile that you do. You would have no trouble understanding each other."

The consumers of utilities are gradually becoming more and more an integral part of the development of electric light and power industry which serves them, by ownership in the companies through the purchase of its bonds and stock. The consumer's stock ownership plan, which found its initiative on the Pacific Coast not over seven years ago, has extended all over the United States, and today the effort of the financial men of large and small organizations has been to place as much of their securities directly in the hands of their employes and consumers as it is possible for them to absorb.

The attitude of the public service corporation should be to not only enlist the investments of consumers, but to make it their business to see that these investing consumers are given full facts in connection with the operation and maintenance of the utility of which they are a part, so that they may be agencies in their communities to help in establishing a true relation as between the utility and the public. With that interest fully centered, it is certain that much of the agitation for municipal ownership or state control would rapidly disappear.

In this connection it is interesting to quote from that dean of the electrical industry, Mr. Samuel Insull, who in an address before the Association of Commerce of Peoria, Ill., on March 11th, 1921, had this to say:

"Efforts to cripple the public utilities under cover of the seductive term 'home rule' are self condemned. The arguments most employed are of no merit and are of questionable sincerity. We are told the utilities should be regulated by local municipal authority instead of by a body of state-wide authority, because under state regulation many of them have been permitted to advance their rates.

"Who has not advanced his selling prices since the war period began in 1914? Who has not had to do it or go broke? As a matter of fact utility service rates have advanced less than any other class of prices, although the utility companies have had to pay two or three times pre-

war prices for their labor and materials, just like the rest of you, and today public utility service is relatively cheaper than anything else we buy—whether for our business, our amusements, our tables or our backs.

"Add up for yourself the groups of people interested directly or indirectly in the utility business; consider, too, that every insurance company, trust company and bank owns public utility securities; and that every owner of an insurance policy or a bank account thus becomes indirectly interested in utilities. Then you will agree that Chairman Jackson of the Wisconsin Commission was right when he said that 49 out of 50 persons picked at random are financially interested, directly or indirectly, in the growth and stability of this great industry."

The long battle for a Federal Water Power Bill has at last ended, and the rules and regulations governing the same have been approved. While not quite up to the expectations of those who have been fighting for a proper recognition of the necessity of water power developments, the clauses of the act are at least sufficiently liberal to permit a trial. The Water Power Act must be given a fair trial to determine whether the public utilities can work under it to the advantage of the public as well as themselves, and your Committee looks for an era of development such as has not occurred in California for many years, and it has come at an opportune time—when the price of oil has made, for economic reasons, a greater necessity for the development of water power.

It was suggested at the Chicago Convention that to avoid the necessary delays in regulation caused by the opposition, usually, of representatives of cities and some particular class of consumers, to applications for increased rates where such increase of rates was warranted by acute increased costs of labor and material, that Commissions in the public interest should consent to a correction factor schedule, applicable to costs of fuel, and perhaps also other important cost items. In California particularly, where within a period of 2½ years oil has increased more than 300% in cost, and where the drouth necessitated great operation of steam units, such a move would do away with the delays which have occasioned, at times, losses of very considerable amount to the public utilities which were not overcome by the adjustment of rates.

Generally speaking, Commission regulation during the past few years has been very thorough and judicial, and we believe has given greater satisfaction to the public and the companies. The decisions of commissions, like the decisions of the courts, are now being regularly published and form a part of the Law Library. The decisions of the courts and the decisions of the commissions are gradually becoming more uniform and judicial as the subject of regulation is better understood generally.

The Investment Bankers Association of America has taken an active part, in its annual meetings, in the discussion of affairs of public utilities, and has cooperated with representatives of the National Electric Light Association in the needs and requirements of all public utilities. In common with the public utilities themselves, they recognize the necessity for frankness in public expression and for the cultivation of public relation and the upbuilding of the integrity of the investment for service to the public, and at its recent convention adopted the following resolution:

"Therefore Be It Resolved, That it is the sense of the Board of Governors of the Investment Bankers Association of America, that there should be cooperation between the Investment Bankers and the owners and operators of public utilities and the regulating officials in laying before the public full information respecting the vital importance of permitting and continuing expansion of all kinds of utility service and encouraging such utility regulation as will provide sound credit as a basis for financing to the end that the investing public may provide the necessary funds by investment in sound public utility securities."

It would appear to your Committee that the member companies have a duty to perform, and that is the dissemination of proper information among the young men and women attending public schools and universities.

Technical journals devoted to the cause have, unfortunately, a limited circulation, and the great daily press only publishes that which is regarded as news and which will attract subscribers, which in turn moves to the expansion of its advertising column. Fortunately, there are some popular journals, such as Collier's Weekly and the Saturday Evening Post, that are now taking up the public

utility side for the purpose of informing the public generally of the truth concerning the great service rendered humanity by the power companies, and on the Pacific Coast the Journal of Electricity and Western Industry is doing heroic work.

We believe it to be true that every man interested in the public utility industry of this country looks forward to the day when his motives will not be misunderstood and maligned, and when the great public will have the same confidence in his expressions as it has in the expressions of any other merchant with whom it deals for the necessary commodities of life.

We of the industry realize that the days of profiteering in public utilities have gone down to the dim and distant past, and that of all of the businesses of this great nation, there is none in existence today that serves the public with a less margin of profit than does the public utility; it is practically doing business on an economical cost basis, earning only sufficient to pay the interest on the money which it must borrow to develop and carry on its work of service, and laying a sufficient margin aside to provide for the depreciation on its property through devotion to public use.

It has been estimated that one horsepower developed in the state of California enriches the state to the extent of approximately $50,000, in the creation of new industries, in additional population, in the building of homes, and the distribution of wealth among those who help to build up this great commonwealth. Assuming the development of 100,000 horsepower annually by the companies of this section, it would mean that the material wealth of this Pacific Coast section would be added to by the sum of $5,000,000,000 annually, contributed in connection with the stable increase of power, not for today but for all time.

To sum up, therefore, let us emphasize the necessity—

for better public relations;

for better care and concern in the welfare of their employes;

for better service to their consumers, and for

better interpretation through the public mind of what their industry means to those immediately served.

Western Hydroelectric Power Projects Recently Completed, Under Construction or Proposed

		Type of Prime Mover	Date of Completion	Present Capacity H. P.	Head Ft.	Ultimate Capacity H. P.	Transmission Voltage
GREAT WESTERN POWER CO.							
Plants Completed Since January, 1920.							
Caribou	Plumas Co. on No. Fork Feather River, 195 miles from San Francisco	2–30,000 h. p. Dbl. Overhung Allis-Chalmers Imp. Wheels	5/ 7/21	60,000	1,108	180,000	165,000
PACIFIC GAS AND ELECTRIC CO.							
Plants Completed Since January, 1920.							
Spaulding No. 2	So. Yuba Riv., Placer Co., Cal.	1–1335 h. p. Allis-Chalmers Turbine	11/ 1/20	1,340	145	1,340	125,000
Hat Creek No. 1	Hat Creek, Shasta Co., Cal.	1–15,000 h. p. W-S-M Turbine	8/ 1/21	16,750	216.8	16,750	60,000 pres. 220,000 ult.
Hat Creek No. 2	Hat Creek, Shasta Co., Cal.	1–15,000 h. p. W-S-M Turbine	10/ 1/21	16,750	201.3	16,750	60,000 pres. 220,000 ult.
Spring Gap	Middle Fork Stanislaus, Tuolumne Co.	1–9,500 h. p. Single Overhung Pelton Impulse Wheel	10/ 1/21	10,050	1,865	10,050	104,000
Work Now Under Way.							
Pit No. 1	Pit River, Shasta Co.	2–40,000 h. p. Allis-Chalmers Single Runner Reaction Turbines	7/ 1/22	93,800	454	93,800	120,000, 220,000 ult.
Work to Be Begun by June, 1922.							
*Pit No. 2	Pit River, Shasta Co.		7/ 1/23	26,800	115	26,800	120,000, 220,000 ult.
SAN JOAQUIN LIGHT AND POWER CORPORATION.							
Plants Completed Since January, 1920.							
Kerckhoff	San Joaquin River, 40 miles from Fresno	3–14,200 Kva. Allis-Chalmers Generators, Francis Vertical Single Runner Type Turbines	8/15/21	54,000	335	.....	110,000
Kern Canyon	18 miles southeast of Bakersfield on Kern River	1 Allis-Chalmers Generator, Francis Type Turbine with White Hydrocone	8/17/21	12,000	260	.....	60,000
Work Contemplated.							
Kings River Project	50 miles from Fresno on North and Middle Forks of Kings River:						
Balch	8 Units		.....	.....	2,385	162,615	.....
Haas	5 Units		.....	.....	2,345	106,590	.....
Helms	3 Units		.....	.....	1,585	50,430	.....
Farnham	2 Units		.....	.....	1,460	33,170	.....
Kings River	2 Units		.....	.....	385	26,250	.....
Woodchuck	2 Units		.....	.....	1,155	10,500	.....
Wishon	2 Units		.....	.....	122	6,830	.....
Meyer	1 Unit		.....	.....	1,395	6,340	.....
Peart	1 Unit		.....	.....	223	4,270	.....
SOUTHERN CALIFORNIA EDISON COMPANY.							
Plants Completed Since January, 1920.							
Big Creek No. 2, 3d Unit	240 miles north of Los Angeles	Impulse Water Wheel	2/ 1/21	23,000	1,858	85,000	150,000
Kern River No. 3	130 miles north of Los Angeles	2–22,500 h. p. Pelton Vertical Francis Turbines	4/ 1/21	42,800	806	42,800	60,000
Big Creek No. 8	240 miles north of Los Angeles	I. P. Morris Vertical Reaction Turbine	8/11/21	30,000	729	167,500	150,000
Work Now Under Way.							
Big Creek No. 1, 3d Unit	240 miles north of Los Angeles	Impulse Water Wheel	6/ 1/23	23,000	2,131	85,000	220,000

Big Creek No. 3, 1st Unit	240 miles north of Los Angeles	3–35,000 h. p. Vertical Reaction Turbines	6/ 1/23	33,500	825	200,000	220,000
2d Unit			9/ 1/23	.....	....	.....	.....
3d Unit			6/ 1/24	.....	....	.....	.....
THE SOUTHERN SIERRAS POWER COMPANY.							
Plants Completed Since January, 1920.							
Adams Auxiliary	Owens River	Pelton Horizontal Turbine	2/22/21	3,375	150	3,375	87,000
Work to Be Begun by June, 1922.							
Forest Home	Mill Creek	Impulse Wheel	.....	4,470	2,000	4,470	87,000
Leevining No. 1	Leevining Creek	1 Single Overhung Impulse Turbine	.....	17,900	1,600	17,900	87,000
CITY OF LOS ANGELES.							
Plants Completed Since January, 1920.							
San Francisquito: No. 2	50 miles from Los Angeles	2–22,000 h. p. Vertical Reaction Turbines W-S-M	8/ 6/20	44,000	530	61,500	110,000
Franklin Canyon	Owens River		6/ 3/21	3,300	....	.....	.....
San Fernando	Owens River		.....	9,300	....	.....	.....
CITY OF SAN FRANCISCO.							
Work Now Under Way.							
Moccasin Creek	140 miles from San Francisco	†3 Double Runner 25,000 h. p. Impulse Turbines	.....	75,000	1,300	150,000	.....
IDAHO POWER COMPANY.							
Plants Completed Since January, 1920.							
Thousand Springs		Reaction Water Wheel	5/ 1/20	11,000	183	11,000	44,000 & 132,000
Shoshone Falls		Reaction Water Wheel	8/15/21	16,500	214	16,500	44,000
UTAH POWER AND LIGHT CO.							
Plants Completed Since January, 1920.							
Oneida Plant	Bear River		.....	40,200	....	.....	.....
Work Now Under Way.							
Olmsted Plant	50 miles south of Salt Lake City		.....	7,370	....	17,018	.....
WASHINGTON WATER POWER COMPANY.							
Work Now Under Way.							
Spokane Upper Falls		Water Wheel	12/31/21	14,250	64	14,250	4,000
CITY OF SEATTLE.							
Plants Completed Since January, 1920.							
Cedar Riv. Unit No. 5		Pelton Turbine, Westinghouse Generator	Tested 9/15/21	16,750	600	33,500 to 37,520	60,000
Work Now Under Way.							
Nehalem	Gorge Creek	Pelton Water Wheel	.....	3,000	....	.....	.....
BRITISH COLUMBIA AND ALBERTA POWER CO.							
Work Now Under Way.							
Bull River	B. C.		.....	5,900	270	.....	66,000
Elk Falls	Elko, B. C.		.....	16,080	270	.....	66,000
BRITISH COLUMBIA ELECTRIC RAILWAY CO., LTD.							
Stave Lake		1–13,000 h. p. Francis Turbine	3/ 1/22	.....	75	47,500	60,000

*Preliminary—subject to change. †Contract not awarded.