HYDROELECTRIC DEVELOPMENTS IN SOUTHERN CALIFORNIA

A Thesis

Presented to

the Faculty of the Department of History

University of Southern California

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

---

by

Robert Charles Catren

June 1942

This thesis, written by

ROBERT CHARLES CATREN

1727C
62-5C

under the direction of his Faculty Committee, and approved by all its members, has been presented to and accepted by the Council on Graduate Study and Research in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

Dean

Secretary

Date June, 1942

Faculty Committee

Chairman

PREFACE

For a number of years this writer has held more than an average interest in hydroelectric development in California. The knowledge that many records had been achieved in this state in the generation and transmission of hydroelectric energy created a desire to learn the contribution which Southern California had made and hence has led to this paper. By Southern California is meant that section of California which is located south of the Tehachapi Mountains.

An introductory chapter is devoted to those activities which brought to this section some of the earliest hydro plants in the world. No claims to greatness or "firsts" are made except where those claims were established beyond doubt. Reference to steam-electric generation and to hydroelectric developments outside the section are made because of their relation to future consolidations and events.

A second chapter carries the story of the creation of an economic empire having as its very foundation the nucleus of two hydroelectric giants. Their struggle for power takes up the first decade of the new century. Many innovations were made during this period. A growing section demanded much from the waters of rivers which were quite distant. Transmission of high-voltage became a companion development of hydroelectric generation; the two are inseparable and must be treated as such.

The third chapter carries events up to 1930. New companies creep into the Southland. Developments spread outside the immediate section adding to transmission problems. California's super-power system is a resultant of hydroelectric advancements. This period saw many abrupt changes in electrical generation. World War I made its demands, and Southern California found itself in good position. In the reconstruction period a source of electric power which would guarantee this section's prosperity was sought, and the ground work for Boulder Dam was laid.

A separate chapter on the municipal system of Los Angeles carries the story of that city's first efforts to establish a separate system together with its growth into a gigantic hydroelectric enterprise. While the next section of the paper contributes little to hydroelectric generation, the expansion of transmission lines into Imperial Valley demonstrates how important electrical energy has been in our modern life. Boulder Dam, its erection and importance in the affairs of Southern California, is expanded in the final chapter.

It would be impossible to place the proper credit for hydroelectric expansion in the Southland upon the shoulders of personalities. Names are mentioned purely for their historical significance and not in the light of their electrical prominence. An attempt has been made throughout the

paper to simplify electrical terms so that an understanding of electricity is not an essential element of appreciation.

The writing of this paper has been made easier by the friendliness and the efforts of the members of my thesis committee. I owe them my thanks and my appreciation. Without the aid of my chairman, Dr. Owen C. Coy, the efficient criticism of Dr. A. R. Kooker, and the pleasant cooperation of Dr. Philip S. Biegler this work would have been of less significance to me. In addition, I wish to thank all others who have so generously aided me.

R. C. C.

Los Angeles, California
June, 1942

H. H. SINCLAIR

TABLE OF CONTENTS

CHAPTER PAGE

LIST OF ILLUSTRATIONS

LIST OF TABLES

CHAPTER I

DEVELOPMENTS BEFORE 1900

Dirty and unkempt, the members of the fur brigade journeyed over the South Pass, and from that gap in the Rocky Mountains they traveled along the tributaries of the main streams and into the broad valleys. Pushing forward relentlessly they defied national boundaries. Jedediah Smith was the first to push overland to Southern California. He was followed by other trappers and explorers. But it was due to the turmoil of war and the gold-rush days that California became the object of tramping multitudes. To these early pioneers we owe much of our nomenclature. Donner Pass, Walker Pass, Owen's Valley, Kern River, are only samples of posthumous fame.

Perhaps it is not too much to assume that many of those early overland arrivals visioned the making of rich lands from the desert wastes by the aid of life-giving fluid from the streams they either followed or trapped for beaver. It is highly improbable, however, that even the greatest dreamer among them ever visioned the making of "white magic" --as electricity is often called--from the potential energy of the wind-swept snows which huddled around the frozen peaks. Today, those same streams and valleys, routes of the early visitors, are paced by majestic steel towers. They

are nearly as plentiful in Southern California as dirty, belching, smoke stacks are in the East.

Stately as they are however, these towers, symbolic of our industrial age, were made possible only through the solution of many problems. The generation, transmission, and distribution of electrical energy have passed through many phases of development. In that growth Southern California has held a position so prominent that its history in this respect is fascinating. Lacking in deposits of coal, the making of electrical energy in Southern California involved problems which resulted in experiments in the transmission of energy which paved the way for startling innovations in that field. Generally, the source of power was far away from the demand and, as this demand increased, the problems of transmission and distribution increased.

Graciously we accept the slavery of electrical energy to do our bidding. Nevertheless, heroes of the past made themselves slaves of their ambitions in making this strange power useful. The invention of the electric light turned darkness into dawn. Advancement in civilization, in man's intellectual attainment has ever gone hand in hand with his progress in the manufacture of artificial light. More than to any other man, the credit for the electric light has been awarded to Thomas A. Edison. By 1879, word that something of large interest was being done in the workshop at Menlo

Park, New Jersey, began to be whispered about in scientific circles.[1] That something, of course, was the beginning of our incandescent lamp. What an advancement in civilization, and what an impetus to the imagination of man it was destined to be.

A man with such an imagination was George Chaffey, a Canadian, who in 1881 made a trip to the Garcia Ranch nestled in the foothills of Mount San Antonio. Interested mainly in founding a colony, Chaffey secured acreage with water rights at a price of approximately a dollar and a half an acre from Captain Garcia. This Colony at Etiwanda saw the beginning of a huge industry in Southern California. As a preliminary experiment George Chaffey installed electric lights at Etiwanda, and it became the first location on the Pacific Slope at which hydroelectric power was developed.[2] Genius is a companion of foresight, and George Chaffey's filing on the waters of San Antonio Canyon proved, eventually, to be a vital issue in the formation of the Ontario Power Company which was organized in a later period.

In 1882 F. H. Howland, representing the Brush Electric Lighting Company, made an energetic canvass in Los Angeles for the introduction of the electric light; and by the end of the

---

[1] Edward Hungerford, The Story of Public Utilities, 147-48.

[2] J. A. Alexander, Life of George Chaffey, 37.

third week in August, forty or more arc lamps had been ordered by business firms and private individuals. Howland proposed to light the city by seven towers or spliced masts--each about one hundred and fifty feet high--to be erected within an area bounded by the Plaza, Seventh, Charity (now Grand), and Main, and supplied from a power house at the corner of Banning and Alameda streets. The electrical energy was to cost seven thousand dollars a year, or somewhat more than was then being paid for gas. This proposition was accepted by the city council, popular opinion being that it was "the best advertisement that Los Angeles could have"; and when Howland, a week later, offered to add three or four masts, there was considerable satisfaction that Los Angeles was to be brought into the line of progress.

Howland was opposed by the gas company and by many who advanced the most ridiculous objections: electric light, it was claimed, attracted bugs, contributed to blindness, and had a bad effect on--ladies' complexions![3] In spite of such opposition, however, Los Angeles was one of the first cities in the United States to be lighted electrically. On the evening of December 31, 1882, the city was first lighted by electricity when Mayor Toberman touched the button that turned on the mysterious current. Rates varied; the service was limited.

---

[3] Harris Newmark, Sixty Years in Southern California, 535.

There were three circuits for private consumers, one running till twelve o'clock midnight for hotels, saloons, etc.; and the other two circuits, known as the merchants' line, ran week-day night till nine o'clock, except Saturday, when they continued till ten-thirty P.M. Store lights cost five dollars per week for the midnight circuit, and $3.50 on both nine o'clock circuits.[4]

Almost magically, a new age was dawning. The streams of Southern California were visited by neither trapper nor gold seeker but by a new type of explorer. He was in search of potential power to be harnessed in the making of "white magic." One of the earliest Southern California hydroelectric projects, designed to serve more than an individual need, was that established at Highgrove in 1886 which served to light the streets of Riverside.[5] In 1887 the first hydroelectric plant in California was constructed at San Bernardino. The power house consisted of a simple generator--based upon the Henry-Faraday discovery which was directly connected to a water wheel employing new type buckets.[6]

Although electric plants, both steam and hydro, were

---

[4] William A. Spalding, History and Reminiscences, Los Angeles City and County, I, 248.

[5] Southern California Edison Company, Outline of Southern California Edison Company, 1938.

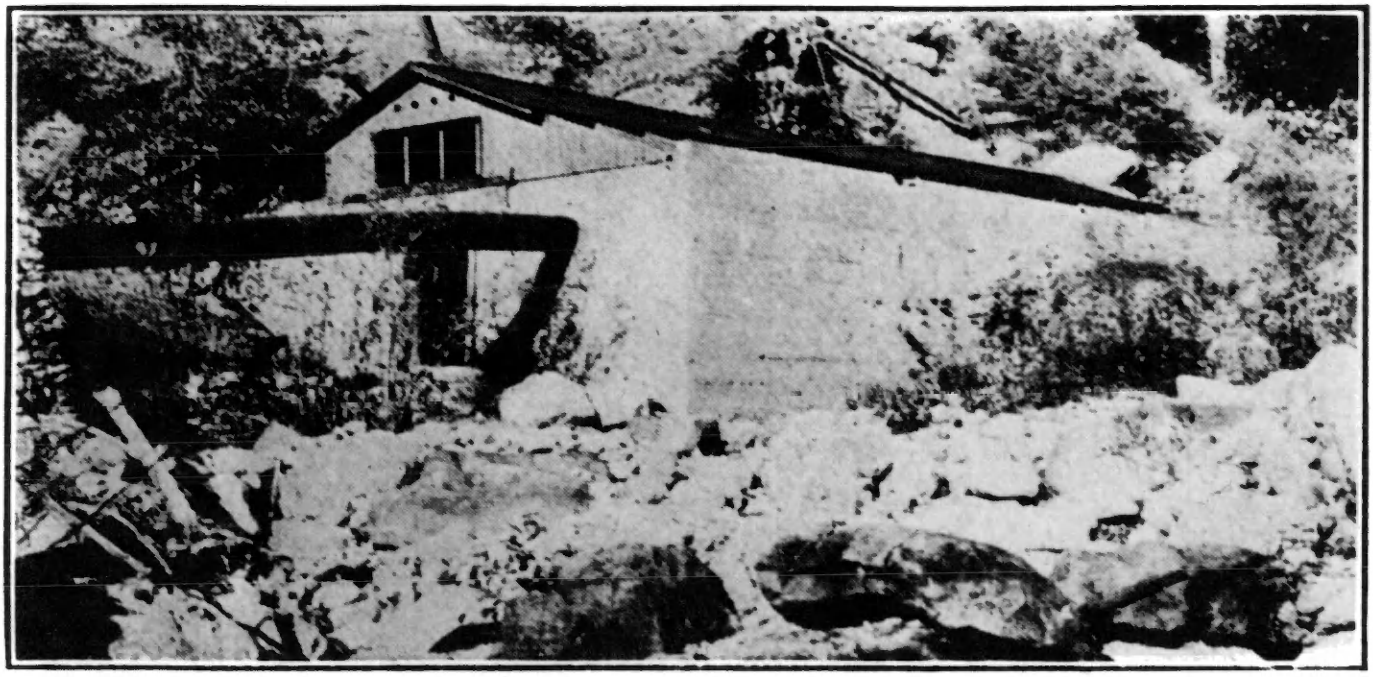
[6] Robert Sibley, "The Power of California," California Monthly, October, 1940.

developing, the transmission of electrical energy was as yet, 1890, practically unheard of. To Dr. C. G. Baldwin of Pomona College must go a great deal of credit for its early progress. Approached by a group of Pomona citizens to name a community project, Doctor Baldwin suggested that a water power group be appointed to investigate the feasibility of constructing a hydroelectric plant. While he pondered what the water power committee might do, he happened to read of a small direct current transmission line four miles long which was supplying the town of Ventura. He immediately went to Ventura and sought the president of the power company, who took him out to the plant and gave him full information as to the methods used, the success attained, and the financial questions involved.[7]

Enthused, armed with an active imagination and a set of plans designed by an engineer because Doctor Baldwin had not been associated with the electrical field, the professor proceeded to Pittsburgh and placed the papers in the hands of the Westinghouse Electric Manufacturing Company. After a short review of the scheme the engineers of the company declared the plans impracticable and refused to have anything to do with the manufacture of the machinery. Doctor Baldwin consulted with Mr. Stanley, of the Stanley Laboratories, who

---

[7] Frederick H. Fowler, Hydroelectric Power Systems of California, 543.



A. OLD POMONA PLANT, THE FIRST LONG-DISTANCE HYDROELECTRIC TRANSMISSION PLANT IN CALIFORNIA.

declared the plans feasible. Westinghouse officials, hearing of Stanley's approval, then ordered the machinery constructed. The San Antonio Light and Power Company, as initiated by Doctor Baldwin, started its hydroelectric plant on San Antonio Creek near Pomona. Energy for commercial lighting was transmitted from the plant to Pomona November 28, 1892, and to San Bernardino December 31 of the same year. The line potential used at first was five thousand volts, but on February 16, 1893, the potential was raised to ten thousand volts.[8]

For the first time in history, in this California line, a higher voltage than that actually generated at the dynamo was carried over the line.[9] And in the words of Doctor Baldwin himself:[10]

> Indeed, no commercial plant anywhere had, up to that time, used over a 4,000 volt current or transmitted over fourteen miles, while this plant boldly attempted a thirty-mile transmission and a 10,000 volt current. Electrically it was far more successful than the highest hope of the Westinghouse company, which made the installation.

Credit for this project should also be given to A. W. Decker, electrical engineer of Altadena, who incidentally designed the electrical equipment for the Mount Lowe inclined railway and built the hydroelectric direct current power plant in

---

[8] Fowler, Hydroelectric Systems, 544-45.

[9] Sibley, "The Power of California," 15.

[10] C. G. Baldwin, "Water Powers in Southern California," Journal of Electricity, VII (January, 1899), 5.

Rubio Canyon for the operation of the mountain railway. Electrical development in Southern California, although in its infancy, was in advance of that of the rest of the world.

Interwoven with the next phase of advancement is the name of Henry Harbinson Sinclair. In ill health, with small hopes for his ultimate recovery, he located in Redlands, California. While climbing the mountains and building himself back to health, Mr. Sinclair saw the possibilities of tremendous power in the streams. He began the promotion of an electric power project in 1892. After many vicissitudes and disappointments, sufficient money was finally gotten together. The Redlands Electric Light and Power Company was incorporated in the spring of 1892, for the purpose of supplying electric light and power for public and private use. Mill Creek No. 1 was built at the mouth of Mill Creek Canyon, eight miles from the town of Redlands.[11] The plant began operation September 7, 1893, by transmitting power from its two 3-phase circuits seven and one half miles. The power was transmitted at generator voltage of 2,400, and the line was designed to give a terminal voltage of 2,300 at Redlands.[12] The plant is distinguished as being the first polyphase alternating current station in California, and

---

[11] B. F. Pearson, Address given at the Dedication of the Memorial to H. H. Sinclair, Redlands, 1926.

[12] Fowler, Hydroelectric Systems, 534.

the second in the United States.[13]

Strides were being taken in hydroelectric advancement, but steam-electric stations were necessary in those localities where the demands for electric lighting multiplied. This item from Pasadena signifies as much:[14]

> The power house is located on Broadway below California street, and comprises, in 1894, three boilers and two engines, with generators of 110-arc light capacity, and 1,200 incandescent capacity also. The company has a contract for three years from January 1, 1894, to supply the city with sixty-eight arc lights; and it has thirty miles of wires throughout the city for its arc and incandescent light service.

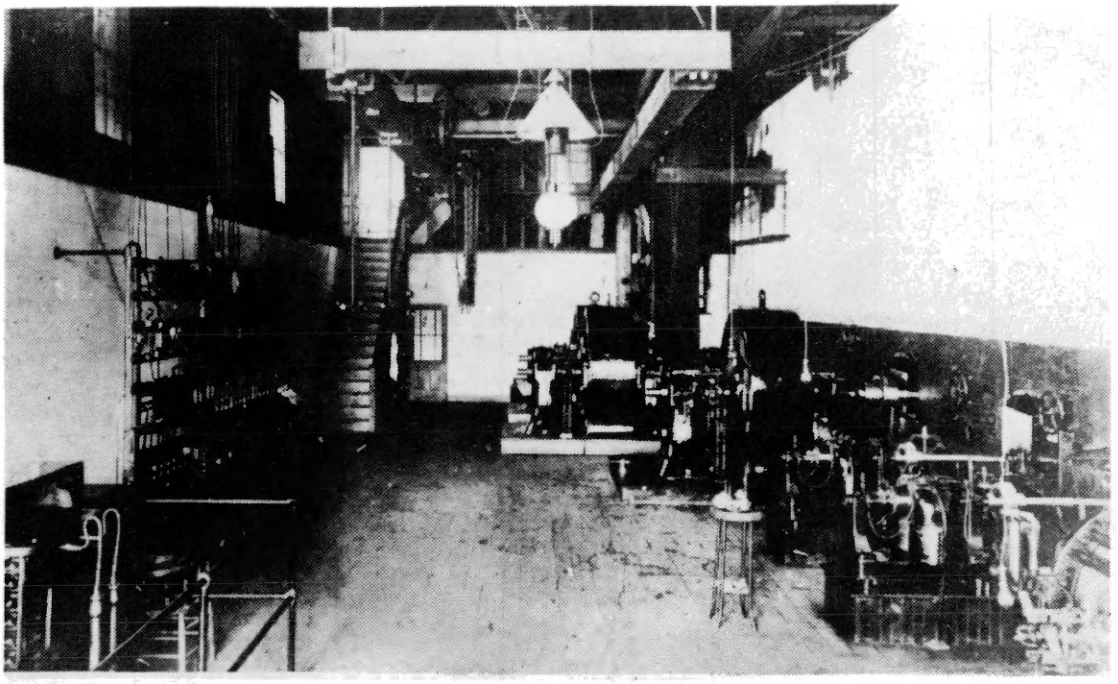
Lighting loads, however, although the main cog in the wheel of electric development, were not the only incentives for the ambitions of the new pioneers. C. G. Baldwin, president of the San Antonio Light and Power Company of Pomona, gave a lecture in Riverside in July, 1895. He named Mill Creek, Lytle Creek, and the Santa Ana and San Jacinto rivers as among the best streams to be relied upon to furnish power the year round in that portion of Southern California. In his address he advised the city trustees to change their call from $40,000 to be voted for a municipal lighting plant, to $125,000. For that amount he believed that 300 horsepower could be delivered in Riverside from the San Jacinto River.[15]

---

[13] Fowler, Hydroelectric Systems, 606.

[14] H. A. Reid, History of Pasadena, 463.

[15] Journal of Electricity, I (July, 1895), 30, stated further: "The original $40,000 indebtedness was voted at a special election held in July, 1895."



America's first hydro-electric three-phase generator installed in Mill Creek Plant No. 1, near Redlands, in 1893. After 42 years of continuous service it was retired from service and placed on a pedestal in the powerhouse. This generator made electrical history by a marked departure from previous generating methods.

Such exorbitant prices for power amaze us today; nevertheless, a new company which entered the field at this time calculated an even higher price. The Journal of Electricity, in 1895, said:[16]

> Los Angeles:--H. Hawgood, Consulting Engineer of the Kern River and Los Angeles Electric Power Company, has sent out a party, under F. H. Olmstead, to locate a route for the transmission line from the point where power is to be generated, to this city, a distance of about 105 miles. It is expected to develop and transmit to Los Angeles 40,000 horsepower, which can be done at a cost of $125 per horsepower.

Such contemplated transmission distance seemed then fantastic. Many cities, at this time looked unkindly at the unsightly pole lines.[17] A new company in Los Angeles, headed by Charles R. Lloyd, of San Francisco, offered to lay all wires underground in the business district. The Los Angeles Edison Light and Power Company, the germ of a gigantic corporation of today, proposed to carry on a general electric lighting and power supplying business and expected to spend $500,000 on a modern plant.[18]

New city companies were increasing. A note in the Electrical World, June 20, 1896, stated: "The West Side Lighting Company, Los Angeles, California, has been formed by E. E.

---

[16]Journal of Electricity, I (August, 1895), 53.

[17]Ibid., 54, stated: "San Diego:--Mayor Carlson has vetoed an ordinance imposing a ground rental of fifty cents per annum for each pole erected or used for electrical purposes."

[18]Electrical World, XXVII (February, 1896), 142.

Peck." Late in 1895, Mr. Peck obtained a franchise from the county supervisors for a small lighting district south and west of the city limits of Los Angeles. With two associates he built a small power house at Twenty-second Street and Vermont Avenue, installed a 30-light arc machine, and in December began to operate.[19]

Hydroelectric activity spread northward as its success in the Southland seemed assured. The North Fork of the San Joaquin River, in Madera County, about thirty-five miles north of Fresno witnessed, in April, 1896, a test of a newly erected plant. Capitalists had recognized the importance of such a project in that great farming area known as San Joaquin Valley. Fresno, the principal town of that enormous valley, was during the last days of May, 1896, the scene of the completion of a great work. This town was the recipient of electrical energy transmitted over the longest distance then attempted, thirty-five miles.[20] A little to the south of the valley a group called the Power Development Company filed for water rights in the Kern River Canyon, sixteen miles east of Bakersfield. The initial installation was completed in the early months of 1897.[21] Future hydroelectric developments and company consolidations in Southern California make the mention of these

---

[19] Fowler, Hydroelectric Systems, 532.

[20] Electrical World, XXVII (June 1896), 786.

[21] Ibid., XXIX (April, 1897), 462.

projects important. This period not only added to hydroelectric and transmission advancement, but steam plants had been either constructed or contemplated in Santa Ana, San Diego, and the beach districts of Long Beach and San Pedro.

Confident in the future of Southern California, a group of promoters organized a new project; they proposed to use the waters of the Santa Ana River to supply Los Angeles with a reliable source of energy. The Southern California Power Company, as the new company was named, was organized by the pioneers of Redlands Electric Light and Power Company in December, 1896.[22] Their proposed transmission line was to operate under a potential of 30,000 volts, which was unheard of up to that time. This line, eighty-three miles long, was surveyed to run through San Bernardino, Pomona, Ontario, Pasadena, and terminate in Los Angeles. Energy profits offered an inducement to men of foresight. And a competing company was organized in an attempt to supply the demands of the city power users and the electric railways, which were beginning to web the Southland, before the Southern California Power Company would be able to complete its project. The San Gabriel Electric Company was thus organized for the purpose of generating and selling power for application to mechanical and other devices.[23] Even at this early time, then, there

---

[22] Fowler, Hydroelectric Systems, 534.

[23] C. E. Fowler, "Water Power Plants with Long-Distance Electric Transmission in Southern California," Engineering News, XLI (March, 1899), 164.

were three companies endeavoring to supply the city of Los Angeles with power from adequate hydroelectric sources: the Kern River and Los Angeles Electric Power Company, the Southern California Power Company, and the San Gabriel Electric Company.

Fervently, companies fought for paramount positions. Communities which found themselves served by rival interests often experienced rate wars. San Bernardino, the very heart of early electrical development, saw such competition. The Electrical World of May 14, 1898, carried this item:

> There has been for five years past very sharp competition in San Bernardino, Cal. for the supplying of electric light and power. The gas company established an electric plant. The San Antonio Company and the San Bernardino Electric Company have been furnishing lights at prices considered about the lowest in the United States. The average price for an incandescent lamp was about 25 cents per month, and for each arc lamp $5 per month. All three companies have been operating at a loss. The result has been that the Gas Company and the San Antonio Electric Company have sold out their interests in San Bernardino Electric Company, which will make no material advance in rates. Some of the San Bernardino papers have advised the inhabitants to burnish up their candlesticks and to purchase oil lamps, since competition has been destroyed.

This episode is indicative of the virile activitiy of promoting groups which were maneuvering for monopolistic control. New fields and new expansions were sought and fought for; power was in demand. A proposed Kern-Rand Company was organized for the purpose of developing the water power of the Kern River, and transmitting it electrically to Randsburg, California, for mining and milling power and lighting loads.[24]

---

[24] Electrical World, XXXI (May, 1898), 601.

To the north and south of Los Angeles the electrical world expanded and, with each new step, there came new records in generation and transmission. Fortunes were being made and spent. Electrical limitations for generation and transmission were shattered. Hydroelectric energy guaranteed to the Southland its industrial and agricultural future.

In a trade journal of July, 1898, we learn:[25]

> The San Gabriel Electric Company's water-power electric station, installed by Los Angeles Capitalists, is now in successful operation. Work has been prosecuted night and day on portions of this transmission line, known as the Kerckhoff system, in order to reach Los Angeles ahead of a competing company.

Then, like a mocking ghost, nature struck at the march of progress with its lofty ambitions. A dry season robbed mountain ranges of their heavy white blankets. Water diminished in volume. The situation became desperate. As early as August the supply failed, as can be seen from this excerpt:[26]

> Fresno, Cal.:- Fresno was in darkness one night recently because of a lack of water in the North Fork of the San Joaquin River to generate power sufficient to run the plant of the electric company to its full capacity. There is a great shortage of water in the mountains, as many of the streams have dried up. The snow has disappeared and the springs have quit running.

Such diminished flow struck at the reserve funds of incorporations. San Antonio Creek dwindled to one-fourth its normal flow. This loss of potential power forced the

---

[25] Electrical World, XXXII (July, 1898), 100. Power was delivered from the Azusa Plant of the San Gabriel Electric Company.

[26] Ibid., XXXII (August, 1898), 172.

sale of the properties to the San Gabriel Electric Company. This drought also held up the delivery of power in Los Angeles by the Southern California Power Company. This company, however, after many vexatious delays, commenced transmitting power over its eighty-three mile transmission line to Los Angeles on January 24, 1899.[27] It was to the Los Angeles Edison Company that the hydroelectric power of the Southern California Power Company was delivered. The West Side Lighting Company which had been consolidated with the Los Angeles Edison Company in 1894 had been able to secure a franchise known as the Scott Franchise within the city limits. In speaking of this transaction the Journal of Electricity stated:[28]

> In order to fulfill its terms, they [the West Side Company] had but two weeks to get current into the City Hall, as the conditions of the Scott Franchise were such that the municipal building had to be supplied with lighting current free of charge during the term of the franchise. Permission was granted by the Los Angeles Traction Company which enabled the plant to put its wires on the street railway poles of the Traction Company and thus it was that Mr. Peck and his associates were enabled to burn a cluster of lights in the City Hall on the night before the day on which the franchise would have elapsed had that not have been done.

The line potential of the Southern California Power Company was 33,000 volts over the longest transmission distance in the world, at that time. The success of this Santa Ana

---

[27] James A. Lighthipe, "An 83-Mile Electric Power Transmission," Cassier's Magazine, XVII (November, 1899),5.

[28] Journal of Electricity, XIII (January, 1903), 14.

plant and transmission line convinced the people of Southern California that long distance transmissions of electrical energy were perfectly feasible.[29] Longing eyes looked on the large potential powers on Kern River, the most accessible of the Sierra streams. Only upon such a source could the future power demands of the section rest securely.

Northward the string of transmission lines searched for new fields, new towns. On January 23, 1899, the Hammond and Wishon interests acquired the distribution system of the Visalia Gas, Light, and Heat Company in Visalia, for which they paid $24,000.[30] The foundation of the Mount Whitney Power and Light Company was secured. Kaweah Plant No. 1 was started early in 1899, and before March work on the entire system, generating and transmitting was being actively prosecuted.[31] Before the year drew to a close the whole power system had become a reality.[32] In the words of an eye-witness:

> There are five substations in all--at Visalia, Tulare, Porterville, Exeter and Lindsay--from which are run 2000-volt distributing lines. The first three mentioned substations aggregate a very fair lighting load, both incandescent and arc, but the principal power is consumed by induction motors of from 5 to 50-h.p., operating centrifugal pumps, which deliver water to the towns and to the extensive citrus orchards in the surrounding country.

---

[29] Fowler, Hydroelectric Systems, 548.

[30] Ibid., 555.

[31] Journal of Electricity, VII (March, 1899), 46.

[32] Donald H. Fry, "Mt. Whitney, California, Transmission Plant," Electrical World, XXXIV (October, 1899), 649.

Centers of population became the objectives of extensions. A race for steady loads often resulted in expensive wars, because this was a new business, a new challenge to the imaginations of restless men. Los Angeles was only a frontier of growth. In April, 1899, the following condition was reported:[33]

> A rate war has broken out between the three electrical lighting companies doing business in Los Angeles, Cal. The base rate for lighting purposes in that city has been 15 cents per 1000 watts, and for business purposes the discount has heretofore been 33 1/3 per cent. At the last account the discount has been increased to 70 per cent; and it was thought that the minimum had not been reached. The cause of the war is the introduction into the city of the two extensive currents of the San Gabriel Power Company and the Southern California Power Company, the latter being controlled by the Edison Company. These two currents are generated by the power of the Los Angeles and Santa Ana Rivers. Their introduction seems to have furnished more current than the people were ready to make use of at the old figures, and sharp competition between the companies resulted. Since Jan. 1 there has been a quiet contest for business at cut rates, and this broke out into open warfare on April 12. Assertions are being made that one or more of the companies is trying to bring about a combination, though each of the companies denies this.

Inevitably, such competition led to forced combinations. Not only in Los Angeles, but in many other sections of Southern California, a mad scramble for control resulted from similar practices. The Edison Electric Company of Los Angeles absorbed the Santa Ana Gas and Electric Company, the Pasadena Electric Light Company, and other local concerns. By tapping the

---

[33] Electrical World, XXXIII (April, 1899), 563.

Southern California system, lines were constructed to Whittier, Orange, Tustin, and Fullerton by the end of 1899. Negotiations between the Edison Electric Company and the Redlands Electric Light and Power Company had begun before the Redlands company had completed its work on Lytle Creek in the Cucamonga Mountains. A second plant went into operation in November, 1899, with two 250-kilowatt, 3-phase, revolving-field machines of 11,300 volts potential.[34] This was the last hydroelectric generating plant completed by the Redlands Electric Light and Power Company.

Strange developments had taken place during the closing years of the nineteenth century. A mysterious, new power had ushered industry along the pathway of progress, hastening her step and promising her a brilliant future. Hydroelectric energy with its proved transmission success, promised isolated sections their share of prosperity. Electric power transmissions for distances approaching 150 miles had been projected in several portions of the West and some of them had passed so far beyond the stages of promotion that they had become all but realities. California seemed destined to continue to lead the world in electric power transmission. It had already done so in pioneership, in distance of transmission, and in the use of the highest commercially

---

[34] A. R. Maujer, "Southern California Edison System," Power, XXXIV (September 5, 1911), 352.

successful line voltage.[35] Southern California, leader in all phases of such developments, faced the new century with confidence and assurance. The age of giants was about to begin.

---

[35] George P. Low, "Editorial," Journal of Electricity, VIII (December, 1899), 131.

TABLE I

HYDRO PLANTS INSTALLED, 1886-1900

Plant	Year
Highgrove	1886
San Bernardino	1887
Pomona	1892
Mill Creek No. 1	1893
Azusa	1898
Santa Ana no. 1	1898
Kaweah No. 1	1899
Mill Creek No. 2	1899

CHAPTER II

A DECADE OF THE GIANTS

The first decade of the present century witnessed the growth of two gigantic corporations, the Southern California Edison Company and the Pacific Light and Power Company. Feverishly, the old century had closed upon an industry which had bumped along its uncertain path to greatness. Hydroelectric power generation, in the Southland at least, had enticed an army of investors as well as an over-enthusiastic group of small companies. The outcome was inevitable. One of the necessary stages in the evolution of the industry was the emergence of a few strong, well-financed and ably-managed corporations and the absorption of the smaller companies by these larger organizations.[1] This consolidation, nevertheless, was not instantaneous; even the small concerns developed gradually.

Forming the foundations of these giant utilities were many companies unknown today. Among them were the Mountain Power Company, organized in 1900, and the San Bernardino Electric Company which had operated a small plant and distribution system at Highgrove.[2] The following year, 1901,

---

[1] Robert G. Cleland and Osgood Hardy, March of Industry, 219.

[2] Frederick H. Fowler, Hydroelectric Power Systems of California, 549.

witnessed a new expansion by the promoters of the Redlands Electric Light and Power Company. Preliminary work on Kern River was the resultant. The new organization, the California Power Company, began what is now Kern River Plant No. 1 of the Southern California Edison Company.[3] Not to be outdone by its rival pioneer competitor the Sierra Power Company, successor to the old San Antonio Light and Power Company, placed in operation its Sierra plant which was located on the very site of the historic Pomona plant, which plant it will be remembered was the first alternating current long distance transmission plant in California.[4]

In April, 1901, the Riverside Power Company was incorporated under the laws of California. Soon after its organization the company, which was formed by local capitalists in Riverside and its immediate vicinity, acquired the right to use a fall on the Narrows canal, which diverts from Santa Ana River in the vicinity of Riverside. A similar project to utilize that portion of the Santa Ana irrigation canal lying above the mouth of Santa Ana Canyon for power development was proposed by the Mentone Power Company incorporated August 16, 1901.[5]

---

[3] Fowler, Hydroelectric Systems, 535.

[4] Southern California Edison Company, Outline of Southern California Edison Company, 1938.

[5] Fowler, Hydroelectric Systems, 547.

Too much emphasis cannot be placed upon the fact that electric railways in Southern California hurried electrical development in all phases of the industry. The San Gabriel Electric Company eventually was connected to the generating system of the Los Angeles Railway. It was this connection which in a few years proved to be of greatest importance in the affairs of the company, leading to the reorganization as the Pacific Light and Power Company, largely as a generating system for the electric railways in and around Los Angeles.[6] Title to the San Gabriel properties was completed on October 1, 1902. This new utility expanded rapidly. Stock control of the Kern River Company was acquired on April 16, 1902. The Borel development, as this Kern River project was called, thus secured an impetus and the plant went into operation December 31, 1904.[7]

Such threatened competition early stirred the ambitions of another behemoth in the making. The Edison Electric Company, in need of greater bonding capacity because of the very rapid extensions of the system, was formed July 27, 1902, under the laws of Wyoming, as successor to the Edison Electric Company of Los Angeles.[8] Just prior to this reorganization

---

[6] Fowler, Hydroelectric Systems, 543.

[7] Frank E. Bonner, Report to the Federal Power Commission on the Water Powers of California, 180.

[8] Fowler Hydroelectric Systems, 536.

the Edison had purchased the properties of the Pasadena Electric Light and Power Company, Mountain Power Company, Lytle Creek Light and Power Company, and California Power Company.[9] Such phenomenal expansion can best be explained by the fact that in 1903 this company had 225 miles of transmission lines in the Southland.[10]

Outside the realm of hydroelectric development, steam generation was beginning to assume gigantic significance. The system of the United Electric, Gas and Power Company comprised formidable proportions as early as 1903. This company, organized in Los Angeles, had been conducted under the policy which proposed the consolidation and modernization of gas and electric plants of different localities, and, more than this, the unification of these electric plants through high-tension transmission lines. In 1903 a San Francisco report stated:[11]

> The gas and electric plants at Santa Monica supply both variety of service to Santa Monica, and electric service through the high-tension transmission lines of the company to Ocean Park, Moneta, Gardena, Inglewood, Hermosa Beach, Long Beach, San Pedro, Terminal Island, Redondo Miramar and Short Line Beach. The company also owns and operates a small separate electric plant at

---

[9] Fowler, Hydroelectric Systems, 533.

[10] George P. Low, "Edison Electric Company," Journal of Electricity, XIII (January, 1903), 39.

[11] "The System of the United Electric, Gas and Power Company," Editorial, Journal of Electricity, XIII (January, 1903), 86.

> Monrovia, which is driven by water power, but, with the exception of its Monrovia plant, its electric systems are steam driven.

This system was purchased by the Edison May 1, 1903.[12]

At this time, however, steam power generation seemed under a serious handicap.[13] Because of the cost of fuel oil every available hydroelectric site was surveyed and filed upon. In addition, the first indication of a future consolidation was unfolded in the creation of the Union Power Company, February 20, 1904, by the Pacific Light and Power Company and Edison Electric Company of Los Angeles.[14] The properties of the company consisted of an undeveloped power site on Santa Ana River and Bear Creek above the intake of Santa Ana No. 1 plant of Southern California Edison Company. Considerable work was done on the tunnels of the proposed developments, but they were finally abandoned.

Such activity has symbolized the advancement of the electrical industry in Southern California, every available source of water power investigated and developed. Our desert

---

[12] Fowler, Hydroelectric Systems, 537.

[13] Statement of Mr. George H. Barker, former President of Edison Electric Co., in Journal of Electricity, XIII (February, 1903), 136: "The long-distance, high-voltage, electric power transmission companies of California can prove to you that they can transmit power from water-power plants to the point of consumption and pay interest on the whole accompanying investment cheaper than they could generate it by steam power if fuel cost them absolutely nothing."

[14] Ibid., XIII (1903), 554.

lands were reclaimed;[15] our territory netted with transmission and distribution lines. Historically, this advancement was without parallel. Even before the close of 1903 the Edison Electric Company held a paramount position, as the following excerpt indicates:[16]

> If American prosperity has increased of late, the transmission development has advanced by a yet more rapid stride, and here in Southern California the engineer may see it all, from its earliest stages to its acme of perfection, and in seeing it he will be struck not only by its historical significance, but also by the unprecedented thoroughness of its hydraulic development and the marked originality in equal thoroughness, which characterizes its every electrical feature. There is now on the system of the company the first three-phase generators, the first synchronous motor and the first induction motor ever turned out for commercial use by the General Electric Company, and it is interesting to note that they are still in daily service as installed, with every indication that they will continue in their duties for years to come.

California had been fortunate, indeed, to have had individuals with foresight enough to recognize the unlimited possibilities of the steep gradient of her streams. Conventions were held by the transmission engineers of the Pacific Coast. Many problems were discussed, and great progress naturally resulted.

---

[15] "Reclaiming Deserts by Electricity," Journal of Electricity, XIV (March, 1904), 106: "One of the interesting sights one may see if he visits the country about Los Angeles, Calif., is the transformation of vast plains of sage brush desert into beautiful and profitable groves of orange trees through the medium of electricity."

[16] George P. Low, "The Generating, Transmission and Distribution Systems of the Edison Electric Company of Los Angeles, California," Journal of Electricity, XIII (January, 1903), 9-13.

During the years 1904-05 new companies were formed; some of them developed, and others fell into decay. The Los Angeles Gas and Electric Company was incorporated in 1904 with a capital stock of five million dollars. This company replaced the Los Angeles Lighting Company, taking its business, franchise, and properties. The United Light, Fuel and Power Company was formed in San Diego. At Santa Barbara the merchants of that city united with the Chamber of Commerce members and incorporated The Merchants' Mutual Electric Light and Power Company. A concerted effort was launched to supply electrical energy at a cheaper rate than that charged by the Edison Electric in that city. At the same time the San Diego Gas and Electric Light Company transferred its properties and holdings to a new corporation formed by capital raised in Chicago, Los Angeles, and San Diego. This corporation has existed to this day as the San Diego Consolidated Gas and Electric Company.[17] Mention is made of these companies although none of them at that time used water power as a source of energy. Steam generation served their purpose because of the isolated character of their separate districts.

It should be kept in mind that the gas and electric interests were consolidated at this time. Even then, however, there were movements developing and growing which claimed that

---

[17] Journal of Electricity, XIV-XV (January to December 1904), passim.

the electric utilities could better serve the public as separate identities. Important as was the electric railway load in and around Los Angeles, the Pacific Light and Power Company reached out into territory adjacent to and already served by its competitor, the Edison. After gaining control of the Mentone Plant this concern purchased from the hands of a receiver, the Riverside Power Company in 1906, although title to the properties was not acquired until November, 1911.[18] Numerous gas interests had been secured through purchase of San Bernardino Gas and Electric Company. In fact, so many gas concerns were absorbed in the following years that out of their consolidation by the Pacific Light and Power finally resulted the Southern California Gas Company of today.

Los Angeles was, at this time, the home of myriad corporations. In 1906 a new company, with a capitalization of $2,500,000, to be known as the Ventura County Power Company, was organized. The small companies included in the merger were the Ventura Water, Light and Power Company, the Oxnard Light and Water Company, and the Santa Paula Electric Company.[19]

---

[18] Fowler, Hydroelectric Systems, 550.

[19] Journal of Electricity, XVII (September, 1906), 187, said: "The object of this consolidation is to erect a transmission line beginning at a sub-station to be located at Castiac, at which the Edison company's Kern River transmission line will be tapped and extended west and south for distributing electric energy for light and power to the cities of Oxnard, Ventura, and Santa Paula, as well as to the entire section of Ventura."

The ultimate control of this power combine passed to the Edison company after its properties had been acquired by the Pacific Light and Power. These comparatively small electric companies used steam as a source of generating power. Their end was inevitable, due largely to the propensity of the era toward trusts and combines.

The first decade of the new century, nevertheless, witnessed an arraignment of forces against monopolies. The reaction against the laissez-faire methods of the past extended to the water power sites within the National Forests. Up to the time in 1905, when the National Forests were put under the charge of the Forest Service, the Interior Department had made no effort to establish public regulation and control of water powers.[20] President Theodore Roosevelt reported:[21]

> On May 1, 1906, an Act was passed granting the use of Certain power sites in Southern California to the Edison Electric Power Company, which Act, at the suggestion of the Service, limited the period of the permit to forty years, and required the payment of an annual rental by the company, the same conditions which were thereafter adopted by the Service as the basis for all permits for power development. Then began a vigorous fight against the position of the Service by the water-power interests. The right to charge for water-power development was, however, sustained by the Attorney-General.

On June 11, 1906, an act to provide for the entry of

---

[20] Robert S. Yard, Our Federal Lands, 118.

[21] Theodore Roosevelt, Theodore Roosevelt--An Autobiography, 403.

agricultural lands within forest reserves[22] further complicated the problem of the power companies, particularly adding to the difficulty of securing transmission franchises over private property.

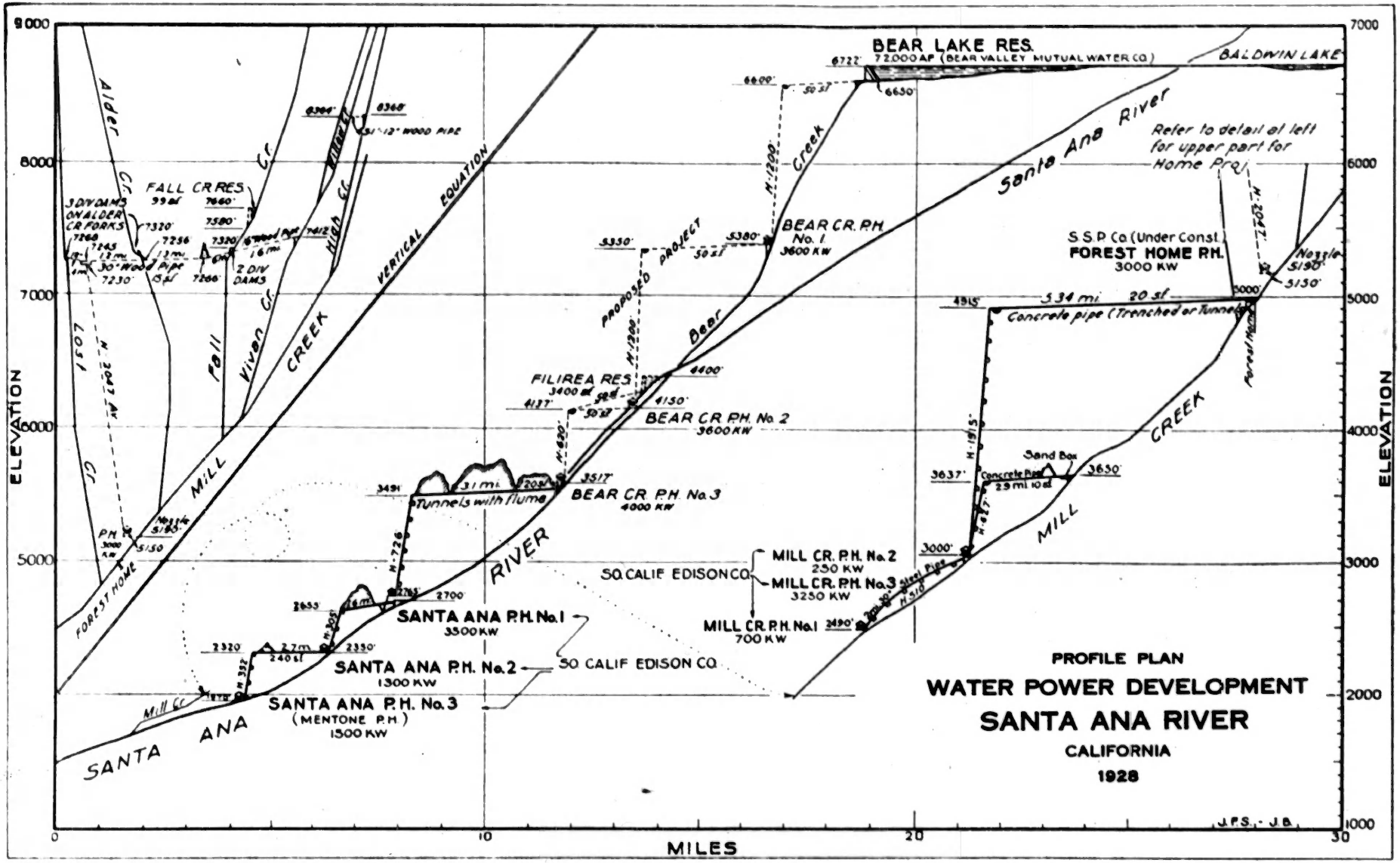
Although the conservation of national resources may take many forms, this "conservation movement" in America is generally considered to have commenced with the agitation of such men as Gifford Pinchot and Frederick Haynes Newell, and to have been promoted by President Theodore Roosevelt who called a famous conference of governors in 1908. The result was the appointment of forty state conservation committees, a national conservation committee and much publicity for the whole subject.[23] Many of the power companies protested what they considered unfair basic charges. Meetings were held over the nation; the Hydroelectric Society was organized. Later, acting upon advice, the Department of Agriculture worked out a plan for the imposition of a so-called "conservation charge" against all power companies operating in the National Forests, based upon the kilowatt hour capacity of the plants.[24]

---

[22] United States, Statutes at Large, XXIV, part 1, 233: "Secretary of Interior was given the right to investigate forest lands, except in a few counties in California, and to open these lands for homestead privileges."

[23] Harold Underwood Faulkner, American Economic History, 4th edition, 687-88.

[24] Charles F. Potter, "History of the Company," Sierras Service Bulletin, May, 1935.



WATER POWERS OF CALIFORNIA PLATE 60

Agitation in many quarters did not stop here, however; for it culminated later in a message by Theodore Roosevelt in which he declared:[25]

> Many bills were introduced in Congress aimed, in one way or another, at relieving the power companies of control and payment. When these bills reached me I refused to sign them; and the injury to the public interest which would follow their passage was brought sharply to public attention in my message of February 26, 1908. The bills made no further progress.

Vastly important to the future prosperity of the region concerned, completed as it was at the very height of the conservation controversy, was the placing in operation by the Edison Electric Company of Kern River Plant No. 1. This plant, probably the most interesting and complete hydroelectric plant on the Pacific Coast, was placed in operation October 20, 1906. The full load output of the plant was more than twice that of all the other company plants combined. Beginning the transmission of power on May 19, 1907, this immense plant seemed the answer in challenge to the Kern River Plant of the Pacific Light and Power which went on the line at a much earlier date.[26] The two companies listed their property valuation in 1907 as follows:[27]

---

[25] Roosevelt, Autobiography, 406.

[26] Bonner, Report to the Federal Power Commission, 180.

[27] Journal of Electricity, XVIII (February, 1907), 157.

Pacific Light and Power Company	$5,747,240.
Edison Electric Company	$3,618,199.

With such activity these two imposing giants of the hydroelectric industry in Southern California moved relentlessly forward along parallel lines of development. There were, nevertheless, many indications of a unified policy of purpose and expansion which forecasted their future consolidation.

There was a strong movement during this particular period toward municipal control of electric systems within corporate limits. Agitation against the large utilities caused threatened loss of revenue to these companies. Glendale, Pasadena,[28] Riverside, and Santa Barbara were among the largest communities displaying such desires. None of these centers contemplated hydroelectric plants; each, however, planned municipal standby plants. One municipality threatened the development of water power sites; Los Angeles had made elaborate plans. Visioning an industrial city, a city of millions, her leaders had schemed for her future. This phase is developed in a later chapter. Other localities, isolated and in need of power, were not to be forgotten by investment seekers. Needles was promised a better standard of living

---

[28] Journal of Electricity, XVIII (April, 1907), 292, reported: "Action in the matter of preventing the city from installing a municipal electric lighting plant has been postponed until April 8. The Edison Electric Company has brought about the litigation."

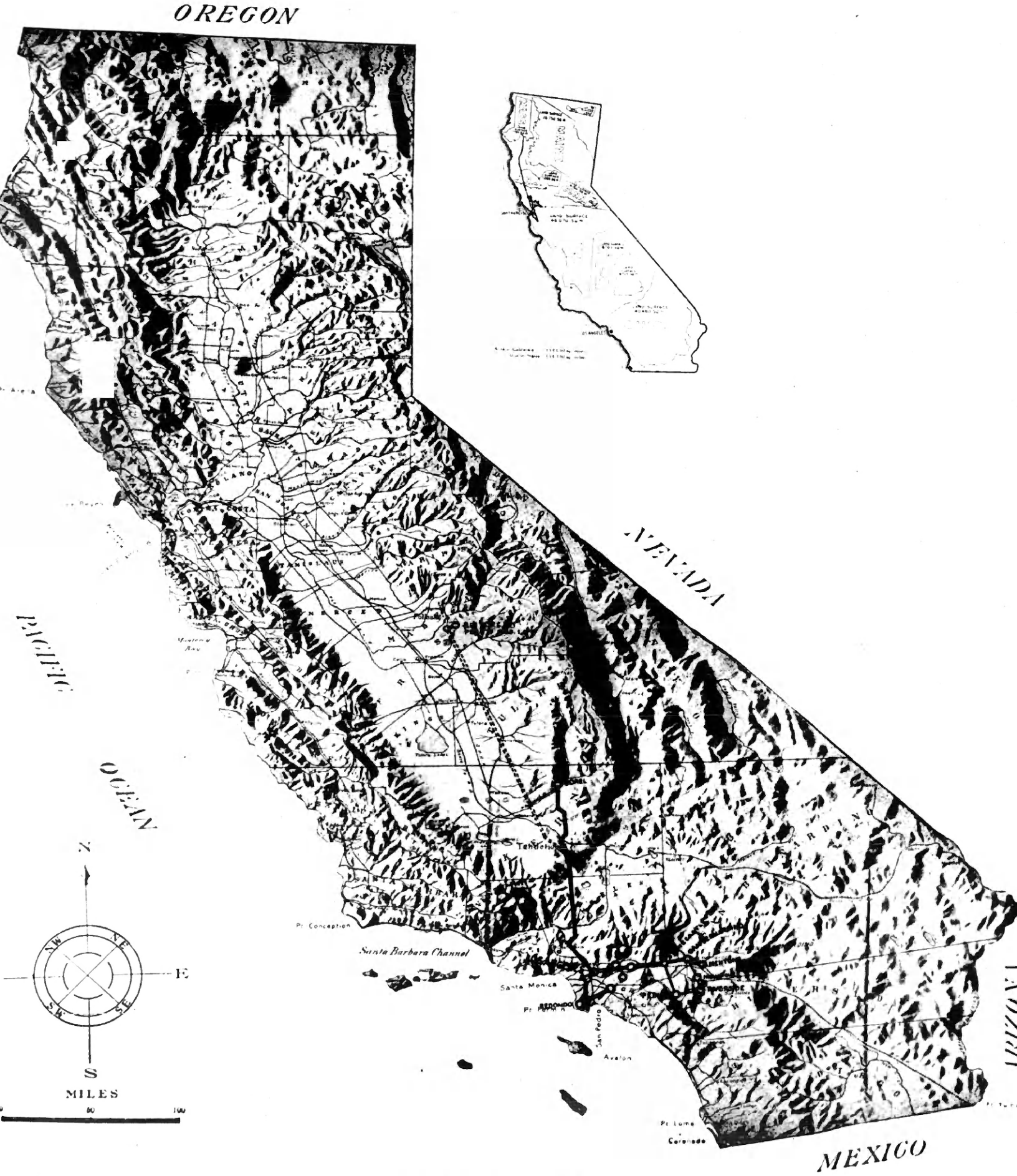
when the Needles Light and Power Company was incorporated at San Bernardino in 1909.[29]

As the decade neared its end, many isolated sections were fed from private plants, steam or gas, and a few hydro-electric concerns carried on their energy development. The Pacific Light and Power Company contemplated the development of two sites far remote from each other: one, a reservoir at Warner's ranch to cost $551,000,[30] the other at Big Creek, a tributary of the San Joaquin River. And so closed the first decade of the century, which had contributed so much not only to the formation of the giants but also to their enormous strides. Southern California seemed to serve as a huge theatre of inductrial conflict where two utility giants thundered their challenges.

---

[29] Journal of Electricity, XXII (March, 1909), 240-59.

[30] Ibid., 260.



RELIEF MAP OF CALIFORNIA

SHOWING PRESENT AND PROPOSED TRANSMISSION LINES OF PACIFIC LIGHT AND POWER CORPORATION

TABLE II

HYDRO PLANTS INSTALLED, 1900-1910

Plant	Year
Sierra	1901
San Antonio No. 1	1902
Mill Creek No. 3	1903
Santa Ana No. 3	1904
Lytle Creek	1904
Borel	1904
Kaweah No. 2	1905
Santa Ana No. 2	1905
Kern River No. 1	1907
Tule River	1909

CHAPTER III

RIBBONS OVER DESERT SANDS

Since the first decade of the new century the Edison Electric Company has carried the name of Southern California Edison Company. Its companion giant which assumed the name of Pacific Light and Power Corporation, 1910, began an ambitious program of hydroelectric development far to the north, on a tributary of the San Joaquin River. It was later to become one of the West's wonder projects. This hydroelectric energy, although generated on Big Creek, above Fresno, was to be used largely in Southern California.[1] When one considers the period in which this project was launched its true significance becomes apparent. Under the liberal land laws many corporations, often by fraudulent methods, had acquired a large part of the mineral resources of the nation; Theodore Roosevelt determined to prevent a similar fate for the water power resources. He hastened to withdraw 148,346,925 acres from public entry.[2] Thousands of western power sites were thus

---

[1] Journal of Electricity, XXVII (April, 1911), 132, states: "Henry Huntington, W. G. Kerckhoff and A. C. Balch have launched an electrical power enterprise, with headquarters in Los Angeles, which will control practically all electric power in the San Joaquin Valley south of Fresno and a large percentage of that to be used in Southern California. The deal involves an ultimate bond issue of between $40,000,000 and $50,000,000; and the construction of one of the largest hydroelectric power plants in the world."

[2] Harold W. Faulkner, American Economic History, 688.

affected by the activity of the United States Geological Survey.[3] The Big Creek hydroelectric development, therefore, was launched in the midst of controversy. Its construction and completion was destined to spread over many years.

The struggle for power in Southern California ended in disputes between municipalities and private interests, and Los Angeles did not stand alone in this respect. There were many rate battles. Pasadena was one of the arenas. A contemporary writer commented:[4]

> The struggle between this city and the Edison Electric Company over lighting was renewed when the city cut the rate at its municipal plant to 5¢ per kilowatt hour. As soon as the Edison people learned that Pasadena intended to cut the price to 5¢ per kw. hour they announced a reduction to 4¢.

Santa Barbara was also having its rate dispute with the Edison. The charge for electrical energy was only one factor in the numerous disputes. New companies were pushing into territory already occupied by major interests. Small business enterprises such as the Ramona Power Company, which sought to utilize the waters flowing from Hemet Dam for power purposes, and the Moron Power Company of Bakersfield, were either absorbed by other interests or fell into the category of forgotten enterprises. As competition increased and powerful new interests infringed on the domain of monopoly,

---

[3] Journal of Electricity, XXIV (June, 1910), 538.

[4] Ibid., 597.

as indeed the giants so seemed to consider, then it became apparent that ruination for all concerned could only be avoided by government interference.

Into such an atmosphere was brought the power of the Railroad Commission of California, which had been created by the State Constitution of 1879. A Constitutional amendment, later adopted by the people, changed the number of commissioners from three to five, and provided that they be appointed by the governor, each for a term of six years.[5] Regulation in its best sense is constructive; for its object is to secure for the public the best service at the rates that are lowest yet sufficient to permit steady expansion of the service, and even better service in the future. The California Railroad Commission has no power to fix rates for, or to control the operation of, public utilities in any incorporated city; but any city may, by a vote of its people, confer this power on the commission.[6] Such regulation, from the standpoint of the municipalities, would seem to work a hardship on private utilities; however, it has proved of great benefit to rate making and allotment of territory as served in this state. That policy not only exemplifies an ideal situation from the

---

[5]California Legislature, Constitution of the State of California, Art. XII, Sec. 22, 1431-44.

[6]State of California, The Statutes of California and Amendments to the Codes, Fortieth Session of the Legislature, 1913, p. 683.

standpoint of the public; it is in the long run equally profitable to utility company owners and their employees.[7] The benefit derived has been mutual after many disputes had forced the commission into a functional body.

The first indication that there was to be a new competitor thrown into this arena of the utility giants came with this announcement:[8]

> Bishop, Cal.:--F. B. Meckling, commercial agent for the Nevada-California Power Company, from Goldfield, has made a trip through southern Inyo and lower Owens Valley and signed up business for the company prospective toward the extension of the power lines down the valley.

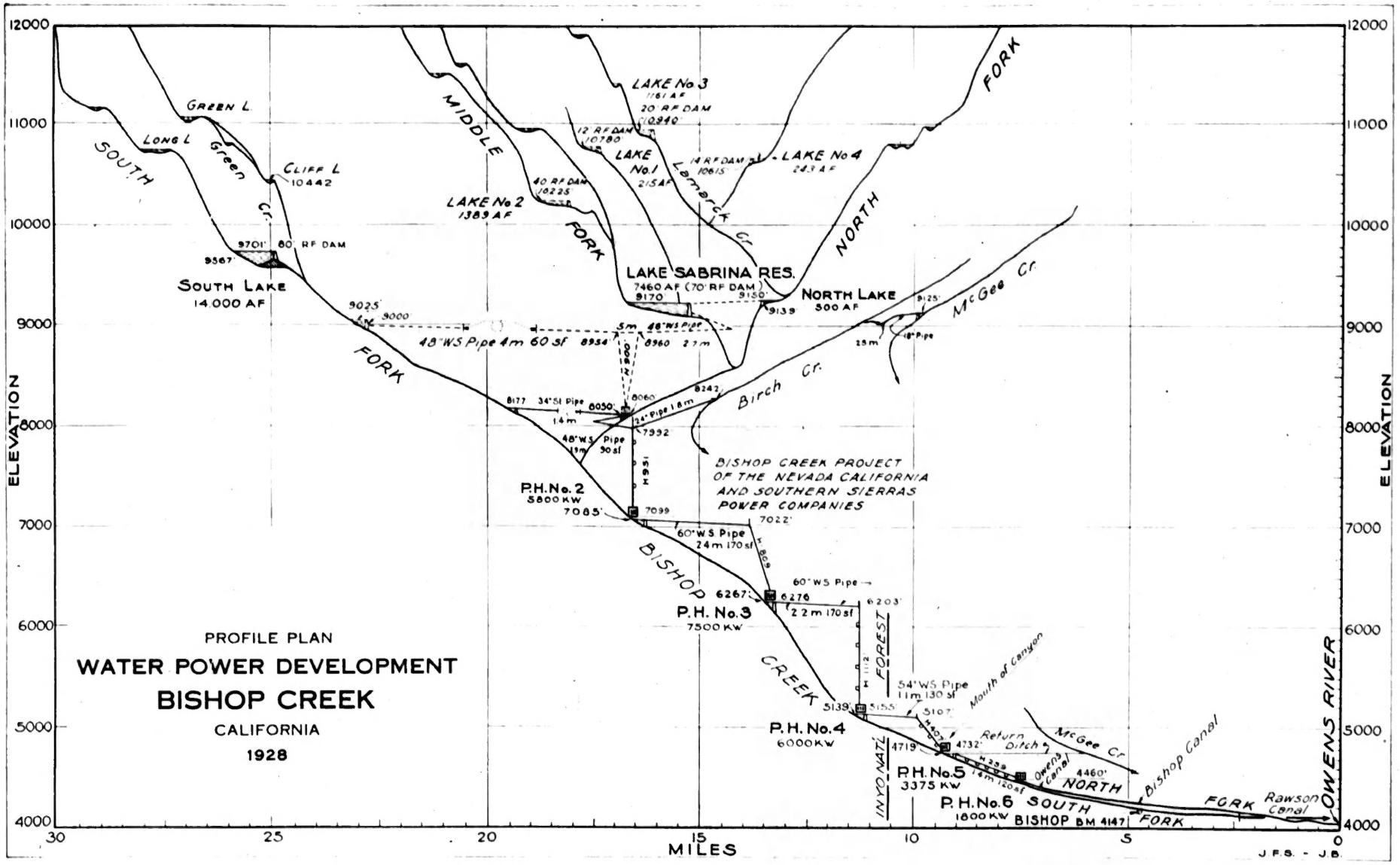
Further preliminaries were presaged by the application to the council in the city of San Bernardino for an electrical franchise covering the city. This was followed by an application to the city and county of Riverside for transmission and distribution franchises.[9] These requests were made in the name of The Southern Sierras Power Company. Great praise should be accorded the founders of this public utility. The vast section east of the Sierra was only a barren desert of shimmering sand before the steel towers of this company crept toward their destination. Supporting copper ribbons of power, these structures brought life, prosperity, and wealth to a land devoid of water or any visible means of growth or promise.

---

[7] George L. Hoxie, Men, Money and Mergers, 157.

[8] Journal of Electricity, XXVI (February, 1911), 127.

[9] Ibid., XXVII (July, 1911), 65-66.



WATER POWERS OF CALIFORNIA PLATE 56

The Southern Sierras Power Company was incorporated on June 15, 1911, under the laws of Wyoming.[10] It was as a subsidiary of The Nevada-California Power Company, which served mining territory around Bodie, that The Southern Sierras Power Company sought the Southern California market. Agents of the new corporation worked diligently to secure a firm foothold in this territory. Title to the remaining properties of the Lytle Creek Power Company was secured in 1911 and at nearly the same time the Corona Gas and Electric Light Company was absorbed. To supply these loads a steam plant was placed in operation in San Bernardino; and lines were constructed to outlying districts such as Corona, Perris, Elsinore, and other sections.

When the great steel tower line from Bishop to San Bernardino, using more than two thousand towers and hundreds of miles of wire, was completed in 1913, its hydroelectric generating and transmission system contained many innovations. Its 238 miles of line was another record for distance transmission. Its unique location on Bishop Creek, where eventually six plants were constructed, presented a feat in engineering seldom equalled. The efficiency of the watershed is practically one hundred per cent. The water after leaving the storage reservoirs does not follow the natural waterway until utilized by the last plant from whence it is discharged

---

[10] Sierras Service Bulletin, November, 1935.

into an irrigation system.[11] The transmission system utilized the outdoor substation which was carried to the fullest extent by the engineers in the construction of their network. California had thus added more new records to her permanent hydro-electric history.

During the years 1911-12 the Pacific Light and Power Corporation, while planning and hastening construction of her Big Creek project, had expanded her field of interest. A new steam-electric power plant had been completed at Redondo Beach at a cost of $1,000,000. This plant was more than twice as large as any similar institution west of New York, and generated 65,000 horsepower.[12] This steam power was used only as standby for the hydro-electric system. The reason for this can best be explained by the following:[13]

> Let us for a moment examine the comparative costs of the two as taken from the books of the corporation for the eleven months ending November 30, 1911. The cost per 1000 kilowatts at the Redondo steam plant was $3.72 for production and $0.28 for maintenance, making a total of $4.00, while, on the other hand, their hydroelectric generation amounted to only $0.33 for production and $0.58 for maintenance, thus making a total of but $0.91.

Although the Pacific Light and Power Corporation served an aggregate population of over 400,000 in its various

---

[11] J. D. Galloway, "Bishop Creek, Cal., Hydroelectric Power Plant," Electrical World, XLVII (June, 1906), 1335.

[12] Journal of Electricity, XXVI (January, 1911), 40.

[13] Robert Sibley, "Pacific Light and Power System," Journal of Electricity, XXVIII (February, 1912), 154.

Supplement to Journal of Electricity, Power and Gas, January 3, 1914

municipalities, about 85 per cent of its power was absorbed by electric railway lines in and around Los Angeles.

An impetus to transmission expansion had been given by a law passed by congress and signed by President Theodore Roosevelt in 1911, guaranteeing a fifty-year tenure of rights-of way.[14] Considerable extensions to the east and north were pushed by The Southern Sierras Power Company at this time. In 1913 this company took control of the Barstow Utilities Company. Lines were constructed to Redlands and San Jacinto; many centers of population in San Bernardino and Riverside counties received hydroelectric power for the first time in their histories. The mines of Randsburg, supplied earlier, had received the life-giving power as had numerous pumping centers, agricultural communities, and industrial plants. Connecting lines to the Holton Power Company in Imperial Valley assured that section of an adequate supply of hydroelectric energy.[15]

When on November 15, 1913, power was sent over the Big Creek line of the Pacific Light and Power Corporation, Southern California's prosperity seemed assured through surplus power. The 241-mile transmission line gave an additional

---

[14] Sierras Service Bulletin, January, 1936.

[15] Charles F. Potter, "History of the Company," Sierras Service Bulletin, July, 1936.

80,000 horsepower of electrical supply to this section.[16] Previous to this and in the immediate years to follow many small systems too numerous to mention were absorbed by the Pacific Light and Power Corporation. Among them, however, were the Glendora Light and Power Company, the Consolidated Utilities Company in Compton, and the San Fernando distributing system of the Edison company.[17] Stock control of the Ventura County Power Company also was acquired.[18]

Hydroelectric power generation was not confined purely to the transmission giants in this area. The Escondido Mutual Water Company was organized in 1905; it fell heir at that time to a system of irrigation conduits, storage reservoirs, and distribution canals which had been constructed in the years 1894-95 by the Escondido Irrigation District. Two hydro plants, the Rincon Plant and the Bear Valley Plant, were constructed and placed in operation in 1915. The Rincon Plant was built near the junction of Paradise Creek and San Luis Rey River. Its companion plant was located on Bear Creek.[19] All

---

[16] H. C. Hoyt, "The Big Creek Development of the Pacific Light and Power Company," General Electric Review, XVII (January-December, 1914), 828.

[17] Fowler, Hydroelectric Systems, 553-54.

[18] Ibid., 541.

[19] Frank E. Bonner, Report to the Federal Power Commission on the Water Powers of California, 167.

surplus power was contracted for by the San Diego Consolidated Gas and Electric Company.

The Nevada-California Electric Company was reorganized as The Nevada-California Electric Corporation on December 12, 1914.[20] The financial backers of this new corporation also purchased stock in small companies feeding territory contiguous to its own, the Holton Power Company of Imperial Valley in particular.[21] As a forerunner to the further expansion of the above company came news from Riverside that the county supervisors had sold to the Coachella Valley Ice and Electric Company, previously formed by the Holton Power interests, the franchise to run electric power lines from Banning through the Coachella Valley to the eastern county line.[22] Connection was made to The Southern Sierras Power Company's extension to El Centro.

An obituary notice appeared in the Journal of Electricity, September 12, 1914:[23]

> Henry H. Sinclair, noted hydroelectric engineer and a controlling factor in electrical engineering fields, passed away at his home in Pasadena, California. Mr. Sinclair was intimately associated with many of the power concerns in his section of the state and at one time was

---

[20] Potter, "History of the Company." Sierras Service Bulletin, December, 1936.

[21] Fowler, Hydroelectric Systems, 765.

[22] Journal of Electricity, XXXII (March, 1914), 286.

[23] Ibid., XXXIII (September, 1914), 256.

vice-president of the Southern California Edison Company, the Redlands Electric Light and Power Company, and the Great Western Power Company.

Indeed, the industry had advanced far beyond the cherished dream of Mr. Sinclair. Perhaps, the men who built the first electric power transmission system in California did not realize how rapidly and to what magnitude the business would grow. Yet in a general way they did appreciate the great advantages to be gained by a power transmission system furnishing power to operate various industries from large efficient power plants, instead of each industry supplying its own power from a small inefficient plant.[24] No testimony could be more convincing than this table:[25]

HYDRO PLANTS IN CALIFORNIA

Year Installed	Number of Plants Installed	Total Kilowatt Capacity
1892	1	482
1894	2	1,230
1896	7	8,190
1898	15	20,715
1900	20	28,695
1902	27	51,565
1904	41	88,465
1906	54	122,265
1908	67	238,985
1910	71	293,095
1912	72	308,295
1914	79	436,045

[24] F. G. Baum, "Economic Value of Electric Transmission," Journal of Electricity, XXXII (January, 1914), 1.

[25] Journal of Electricity, XXXIV (June, 1915), 442.

Little hydroelectric development took place during 1915. Several factors seem to have contributed to the slump in activity: the cost for steam power dropped sharply, giving hydro power severe competition; the uncertainty of the future due to the ravages of the European war; governmental restrictions to water power development; and the imposed charge of the State for use of waters within its boundaries.

The following years witnessed complete severance of the gas properties from the Southern California Edison Company, thus making that giant utility purely an electrical public servant. Then, in June, 1916, the first electrical connection between the Edison and The Southern Sierras Power Company was made at Colton, California.[26] This was the inception of a growth of transmission lines in California known as the super-power system. Such innovations gave special impetus to consolidation of purpose and, in some cases, actual consolidation of business enterprises. Duplication in transmission and distribution fields gave rise to one of the most important consolidations in the history of Southern California. In December, 1916, the Southern California Edison Company filed application with the Railroad Commission of California for permission to acquire the entire properties, including franchise, of Pacific Light and Power Company and, on May 22,

---

[26] Sierras Service Bulletin, December, 1937.

1917, such permission was granted.[27] With an estimated annual savings of $400,000, the gigantic merger gave to the enlarged Southern California Edison Company a total capitalization of approximately $77,000,000. The power reserve amounted to: 16 hydroelectric plants of 156,500 horsepower, and 8 steam plants of 141,770 horsepower.[28]

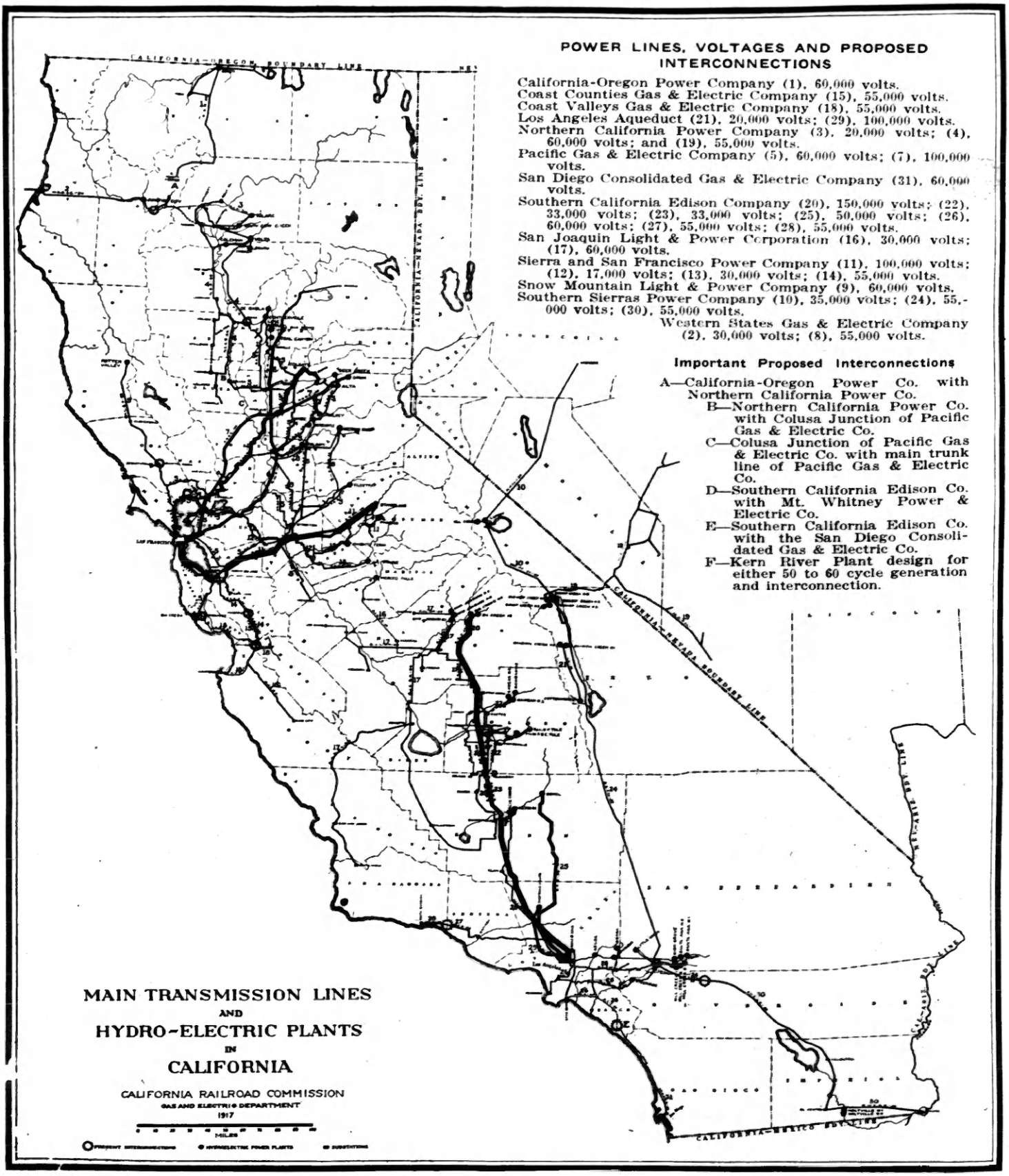
Another hydroelectric record for California was achieved in 1917 when The Southern Sierras Power Company extended its transmission lines to Yuma, Arizona, and to the Mexican border at Calexico. New plants had been built upon Rush Creek. Further construction was contemplated at that time by The Nevada-California Power Corporation, and through its subsidiary, The Southern Sierras Power Company, its tentacles of steel and copper crept throughout southeastern California. The distance from Wonder, Nevada, through Bodie to Bishop to San Bernardino to El Centro and ending at Yuma is 654 miles; and from the generating plant on Rush Creek to the end of the transmission line at Yuma, a distance of 530 miles, was the greatest distance ever attempted in the history of electrical engineering.[29] Through such feats as this and numerous others,

---

[27] Fowler, Hydroelectric Systems, 530-31.

[28] Journal of Electricity, XXXIX (July 1, 1917), 42.

[29] P. M. Downing, "Transmission Line Problems in the West," Transactions of the American Institute of Electrical Engineers, XXXIII (February, 1914), 124-25.



How the Upbuilding of the West is Helping to Win the War — X

HERE is exhibited a district served by the greatest hydro-electric companies in the world. This particular district produced almost a billion dollars in agricultural wealth and in excess of a billion dollars in manufactures during 1917 — an increase of 30 per cent over the previous year. Agricultural and industrial life in the West are so intimately linked with electric power supply that any effort looking toward increasing the efficiency of its vast networks of hydro-electric power may well be classed as war service of the first order.

California has retained her leadership in hydroelectric advancement.

The entrance of the United States into the World War seemed the signal for additional hydroelectric development. Policies, federal and state, which had hampered the unrestricted expansion of the power sites, were changed to a demand for more and more power. This item gives one a lucid picture of conditions:[30]

> The government will give financial aid to the development of hydroelectric projects in California if they can be shown to be essential to war activities.

It was during this same year that the Administration Emergency Power Bill was passed. It provided for government acquisition and extension of electric power plants. It authorized the expenditure of $175,000,000 for extending existing plants and for building new ones.[31]

Extremely serious conditions prevailed throughout the entire Pacific Coast during the war period. California in particular felt the drastic shortage of electric power. Steam generation was inadequate; demands of war industries and public necessities, combined with the shortage of water caused by a lack of snow and rain during the previous seasons, created a situation never before experienced in this section.

---

[30] Journal of Electricity, XL (May, 1918), 484.

[31] Ibid., XLI (October, 1918), 377.

Southern California, however, was in better condition than other sections of the coast.[32] Determined that only supreme effort could solve the many problems, the three hydroelectric utilities of this section met the challenge. The Nevada-California Power Company forced to completion its Rush Creek developments. San Francisquito No. 2 of Los Angeles Bureau of Power and Light was completed. The Southern California Edison Company announced the starting of active work on a hydroelectric construction program that proposed the eventual expenditure of $125,000,000;[33] such a monstrous program meant new life to the ten counties already served by this giant public utility.

Independent activity of small units also met the challenge of electric power demands. In 1919, Plant No. 2 of the Ontario Power Company was constructed.[34] The power house, now a part of the Edison system, is located above the point of diversion for the Sierra plant of the Southern California Edison Company. Also a new organization, the Sespe Power Corporation, planned the construction of five hydroelectric power units on the Sespe River, Ventura County. The total output was to have been taken by the Edison.[35] These plans, however, did not materialize.

---

[32]Colonel Charles Keller, The Power Situation During the War, 85.

[33]Journal of Electricity, XLII (April, 1919), 335.

[34]Bonner, Report to Federal Power Commission, 181.

[35]Journal of Electricity, XLV (October, 1920), 394.

Booming into 1920 the hydroelectric situation assumed the spotlight in power generation. One of the most noticeable facts in Southern California was that the power generated by hydro plants of the Nevada-California Power Corporation was 97.8 per cent of their total electrical energy production.[36] This was a high value in comparison with the following table for the first six months of the year:[37]

KILOWATT HOURS

	Water power	Fuel	Totals
California	1,219,179	527,900	1,747,079
West	3,062,140	766,842	3,828,982
United States	8,274,293	13,572,222	21,846,515

And although the water situation was so acute that the Railroad Commission found it necessary to appoint a Power Administrator,[38] who took general charge of the use and distribution of the limited water supply, the year 1920 was extremely significant in transmission history. It will long be remembered as the year in which California started actual construction

---

[36] Potter, Sierras Service Bulletin, January, 1913.

[37] United States Geological Survey, "Production of Electrical Power and Consumption of Fuels by Public Utility power plants in the United States in 1920."

[38] Sierras Service Bulletin November, 1938.

of the first 220,000-volt transmission system.[39] Soon to follow on the heels of this northern network, however, was the conversion of the Big Creek System of the Southern California Edison in 1923 to this same voltage.[40]

Before this section was to receive such tremendous voltage boosts many new additions and changes had taken place within the Edison enterprise. The company, under a previous plan to expend a million dollars a month for a period of two years for stupendous expansion on the San Joaquin River, had insured Southern California's industrial greatness, as the following excerpt indicates:[41]

> Warned by the power shortage in 1920, the Edison Company has this year added three new important units the $10,000,000 on Kern River with its 40,000 horsepower installation, 22,000 horsepower capacity added to Big Creek Number Two, and the Big Creek Number Eight just completed with an initial capacity of 30,000 horsepower.

This article tells nothing of the railroad construction into the mountains, or of the numerous tunnels burrowed from solid rock, or of the hazardous road building and hauling, or of the man-made lakes so necessary in the separate stages in the development of this wonder project. This activity, however,

---

[39] "High Sierra Hydro-Electric Development," Electrical World, LXXVI (October, 1920), 847.

[40] Southern California Edison Company, Outline.

[41] R. E. Smith, "Big Creek Plant Adds 30,000 Hp. to Western Power Supply," Journal of Electricity, XLVII (September, 1921), 188.

was outside the realm of Southern California and can only be mentioned. Its hydroelectric power, nevertheless, found a market here, amid expanding industries and soaring population growth.

Mention has been made of the Mount Whitney Power Company. On July 1, 1920, this system was combined for operation with that of the Southern California Edison. The acquisition of these plants added 9,350 kilovolt-amperes hydroelectric and 8,437 kilovolt-amperes steam-electric capacity to the giant network of the Southern California utility.[42] The waters of the Kaweah River were thus connected to the driving force of factory wheels in Los Angeles and its vicinity. Today the Edison has three plants on the Kaweah; and its transmission lines extend far to the north of that river.

Rapid growth of industry, of agriculture, and of population caused the hydroelectric companies in Southern California to search for a supply of water which would satisfy the needs of a clamoring community. Los Angeles sought expansion on the Owens and Colorado rivers. Government reclamation plans included a survey of the mighty Colorado and its numerous tributaries. Preliminaries of consolidation demands for an adequate volume of water for population expansion. Concurrent with these first developments was an

---

[42] Fowler, Hydroelectric Systems, 531-557.

editorial in the Journal of Electricity, 1921:[43]

> An increase of available horsepower, equal to one-half of the total hydroelectric energy now generated in the entire United States is involved in the ultimate plans of the Southern California Edison Company in connection with their proposed Colorado River project. An application for a preliminary permit to develop this energy from the waters of the Colorado river has recently been accepted by the Federal Power Commission.

This preliminary application called for a dam near the Crossing of the Fathers. Other applications desired a dam site in Black Canyon. A conference of seven western states' governors was held in Denver, Colorado, May 6 to 11, 1921. Their concern in the utilization of the Colorado River, with its millions of potential horsepower, gave cognizance to the fact that they were well aware of the part the Colorado development was to play in the growth of their commonwealths.

In the face of such activity a movement in California, to buy outright all the electric utilities in the state for a sum of five hundred million dollars, was launched in 1921. This bill, voted on in 1922 as a proposed amendment to the constitution, became known as The Water and Power Act.[44] On November 7, 1922, the people of California refused to accept the proposal by defeating the measure for state ownership.[45]

---

[43]Editorial, "Gigantic Colorado River Project," Journal of Electricity, XLVI (January, 1921), 60.

[44]Potter, Sierras Service Bulletin, June, 1939.

[45]Editorial, "The Lesson of the Water and Power Controversy," Journal of Electricity, XLIX (November, 1922), 350.

To counteract propaganda of the proponents of the Act the private utilities brought before the people the fact that electric rates in California were far below the rates in other sections.[46] Large arguments for legitimate business enterprise under direct state regulation were advanced. The great general use of electricity in California compared to other states, such advancement having been made under private initiative, was emphasized.

During 1922 a new concern, the San Gorgonio Power Company, with headquarters at Banning, contracted for the building of two plants along the diverted Whitewater River north of Banning. A contract with The Southern Sierras Power Company enabled the latter company to take the entire output of the plants at their completion in 1923. Also, late in 1923, The Southern Sierras Power Company decided to rush their Adams Plant in the Owens River Gorge. A shortage of hydroelectric power due to a lack of water accelerated its development, and the plant was placed in service in October, 1924. Also Leevining Creek Plants No. 1 and No. 3 were completed in 1924.[47]

---

[46] "The Cheapest Power Rates in the United States," Editorial, Journal of Electricity, XLVIII (June, 1922), 473, states: "On the basis of the cost to the consumer per kilowatt-hour generated, the rate in the different sections of the nation are as follows: New England States, 2.82 cents; South Central States, 2.65 cents; Atlantic States, 2.09 cents; North Central States, 1.82 cents; Pacific and Mountain States, 1.57 cents; with the average rate of California as reported by the California Railroad Commission of 1.42 cents per kilowatt-hour."

[47] Bonner, Report to the Federal Power Commission, 187.

On their Forest Home site, Mill Creek, in the San Bernardino Mountains the Sierras company began constructing a plant this same year. Their Rincon Line tie-in with the San Diego Consolidated Gas and Electric Company was completed on August 19, 1924.[48] With this important link, another chain was added to California's super-power system which had enabled industry and agriculture to conduct their activities unabated. Testimony of the importance of the power industry can be gained from the following notation:[49]

> The history of the growth of the hydroelectric industry from a total capacity of 30,500 kilowatt hours in 1900, to a capacity of 1,366,000 kilowatt hours in 1925, has an element of fascination about it that cannot altogether be measured in units of electric energy or of dollars invested and dividends disbursed.

Matching every stride in electrical advancement, Southern California seemed determined to add to its elaborate history of hydroelectric generation and transmission. Senator Hiram Johnson and Representative Phil Swing from California introduced a bill in both Houses of Congress providing for the construction of the Boulder Dam Project on the Colorado River. It was reported favorably by the House Irrigation and Reclamation Committee.[50] Agitation in favor of building a high dam forced

---

[48] Potter, Sierras Service Bulletin, June, 1940.

[49] Robert G. Cleland and Osgood Hardy, March of Industry, 218.

[50] Electrical West, LVIII (January, 1927), 46.

considerable delay in the final enactment of the measure. That the river had been looked upon as being of major importance in the growth of its surrounding territory was best ascertained in former proposals to utilize its potential resources, for irrigation as well as hydroelectric power. The river, being navigable, depended upon government legislation for its development. As early as 1906, however, this item appeared in a western publication:[51]

> William Carruthers and John Campbell, who a few weeks ago filed upon 25,000 inches of water at the Black Canyon of the Colorado, are planning to erect a dam at the lower end of the canyon and to develop a minimum of 110,000 h.p. for transmission to the mines on either side of the river. The running of a transmission line to Los Angeles, a distance of 260 miles, is being contemplated.

Also from Tonopah, Nevada, articles incorporating the Colorado River Hydroelectric Company had been filed in 1914; an earlier movement from the same city had instituted a similar project in Boulder Canyon in 1909.[52]

A succession of dry years extending from 1920 to 1927[53] made it imperative that an unfailing supply of electrical energy be guaranteed. All utilities in Southern California expanded their hydroelectric developments. The decreasing cost of fuel witnessed an increment in steam generation. The

---

[51] Journal of Electricity, XVI (January 1906), 34.

[52] Ibid., XXXII (January-June, 1914) 46-238.

[53] Bonner, Report to the Federal Power Commission, 160.

huge steam plant of the Southern California Edison Company at Long Beach which was first operated in August, 1911,[54] was expanded into several operating units. Then actual consolidation between the Edison and the Ontario Light and Power Company resulted in 1927. Several new hydro plants were rushed to completion on Big Creek. And with their output, plus the total capacity of the company's Long Beach steam plant, the Southern California Edison Company became the fourth light and power utility in the United States to join the million-horsepower class.[55] In order better to appreciate the part played in the development of Southern California by the Big Creek hydroelectric expansion these figures are truly significant:

Energy Transmitted from Big Creek to Los Angeles[56]

Year	Kilowatt-hours
1913	19,913,328
1918	260,262,933
1923	578,560,697
1928	1,659,000,000

In order that the people of this section might be more adequately served, a third 220,000-volt transmission known as the Vincent Line was built through Antelope Valley between Los Angeles and Big Creek.[57]

---

[54] Fowler, Hydroelectric Systems, 676.

[55] Electrical West, LXI (November, 1928), 249.

[56] Loc. cit.

[57] Southern California Edison Company, Outline.

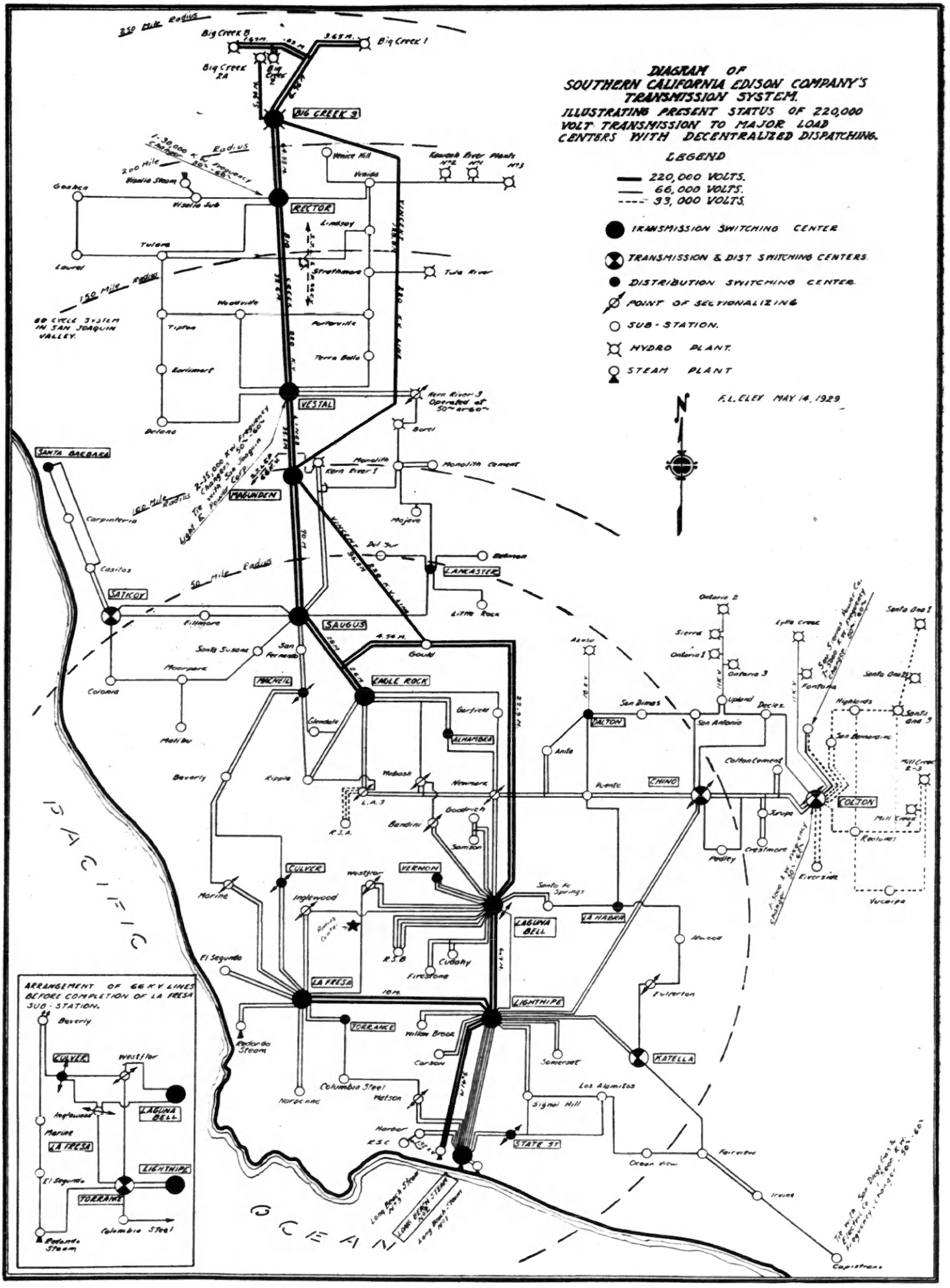


DIAGRAM OF
SOUTHERN CALIFORNIA EDISON COMPANY'S
TRANSMISSION SYSTEM.
ILLUSTRATING PRESENT STATUS OF 220,000
VOLT TRANSMISSION TO MAJOR LOAD
CENTERS WITH DECENTRALIZED DISPATCHING.
LEGEND
220,000 VOLTS.
66,000 VOLTS.
33,000 VOLTS.
TRANSMISSION SWITCHING CENTER
TRANSMISSION & DIST SWITCHING CENTERS.
DISTRIBUTION SWITCHING CENTER.
POINT OF SECTIONALIZING
SUB-STATION.
HYDRO PLANT.
STEAM PLANT
F.L. ELEY MAY 14, 1929
BIG CREEK 3
RECTOR
VESTAL
MAGUNDEN
SAUGUS
EAGLE ROCK
LAGUNA BELL
LA FRESA
LIGHTHIPE
TORRANCE
VERNON
CULVER
ALHAMBRA
CHINO
COLTON
KATELLA
STATE ST
SANTA BARBARA
SATICOY
LANCASTER
ARRANGEMENT OF 66 K.V. LINES
BEFORE COMPLETION OF LA FRESA
SUB-STATION.
PACIFIC
OCEAN

On December 21, 1928, Congress passed an authorization and on the same day President Coolidge signed the Boulder Canyon Project Act.[58] Ratification of the project was also necessary by the several states concerned. Much political delay was experienced; the seven states held many disheartening conferences. Arizona dissented and refused to sign the compact. The remaining six states accepted the Boulder Canyon Project Act within the requisite six months, and President Hoover proclaimed it a law, June 21, 1929.[59] Thus the pathway had been cleared for the erection of a mighty structure which would embody the latest in hydroelectric generation. But Los Angeles was nearly 300 miles away and, what seemed more astounding, the now traditional voltage of 220,000 was not considered high enough to give maximum results under proposed generator design. Almost ironically would be a posthumous comparison with the achievements of William G. Kerckhoff, a mighty pioneer in this industry, whose obituary appeared in the Electrical West, 1929:[60]

> His vision of the great possibilities of hydroelectric power came from his connection with the Azusa Ice and Cold Storage Company whose plant was run by water power. In 1897 with Allen C. Balch he built a hydroelectric plant on the San Gabriel River and transmitted power to

---

[58] Los Angeles, Times, October 10, 1936.

[59] Electrical West, LXIV (June, 1930), 612.

[60] Ibid., LXII (April, 1929), 191.

> Los Angeles. With Henry E. Huntington he organized the Pacific Light and Power Corporation, constructing plants on the Kern River with a 120-mile, 33,000-volt line to Los Angeles, a colossal achievement in thos early days.

Into the life span of one pioneer had been crowded the building of a gigantic enterprise. From its early inception to a living dynamo of industrial necessity, of agricultural dependence, and of population's cultural and social advancement, had gyrated that strange power of hydroelectric energy.

TABLE III

HYDRO PLANTS INSTALLED

Plant	Company	Year
	SOUTHERN CALIFORNIA EDISON COMPANY	
Kaweah No. 3		1913
Big Creek No. 1		1913
Big Creek No. 1		1923
Big Creek No. 1		1925
Big Creek No. 2		1913
Big Creek No. 2		1921
Big Creek No. 2		1925
Fontana		1917
Kern River No. 3		1921
Big Creek No. 8		1921
Big Creek No. 3		1923
Big Creek No. 2-A		1928
San Antonio No. 2		1919
San Antonio No. 3		1922
	SOUTHERN SIERRAS POWER COMPANY	
Bishop Creek No. 4		1905
Bishop Creek No. 4		1917
Bishop Creek No. 5		1907
Bishop Creek No. 5		1919
Bishop Creek No. 5		1923
Bishop Creek No. 2		1908
Mill Creek		1911
Mill Creek		1923
Bishop Creek No. 6		1913
Bishop Creek No. 6		1920
Bishop Creek No. 3		1913
Bishop Creek No. 3		1920
Bishop Creek No. 3		1923
Rush Creek		1916-17
Adams Auxiliary		1921
San Gorgonio No. 1		1923
San Gorgonio No. 2		1923
Adams Main		1924
Leevining Creek No. 1		1924
Leevining Creek No. 3		1924
	ESCONDIDO MUTUAL WATER COMPANY	
Bear Valley		1915
Rincon		1915
	UNITED STATES GOVERNMENT	
Yuma		1926

CHAPTER IV

MUNICIPAL POWER COMES TO LOS ANGELES

Los Angeles is, indeed, an electrical city. Laying claim to the fame of being the first city in the United States to be lighted commercially by electricity, this giant metropolis exists today mainly because of its position and its enormous supply of electric energy. Neither of these conditions were mere matters of chance. The unquestionable, almost fantastic, foresight and planning of its leading citizens are the keystones in its development. Although this city today numbers its electrically operated factories and mills by the thousands, this was not always so. In 1902 Mr. G. P. Low stated:[1]

> The greater proportion of the consumption of electric power is for electric railway purposes, which together with the lighting service, constitute the bulk of the electrical business in and about Los Angeles in particular. People go to Los Angeles to live. Southern California is a land almost without factories or heavy manufacturing interests.

Neither the water supply nor the means for developing an adequate amount of hydroelectric energy was found to be adjacent to Los Angeles. Water power had been applied very early in the community's growth, however. Historical records indicate that the first water wheel successfully operated in Southern California was designed and constructed by Joseph

---

[1] G. P. Low, "Southern California Transmissions," Journal of Electricity, XII (July, 1902), 16-17.

Chapman. The stone-walled grist mill which Chapman built and operated over one hundred years ago stands to this day, the father of water power in Southern California.[2] But water in this section is an unstable quantity. A series of dry seasons may produce a serious shortage. And so it was that in 1905, with a population of only 160,000, Los Angeles suddenly realized that the Los Angeles River, then her source of water, would be totally inadequate for the support of future growth. Unless additional water could be brought in from a new source, the city faced certain stagnation and heavy business losses.

This new source proved to be the perpetual snow fields of the High Sierra. To the northwest of Los Angeles lies the watershed which drains into the Owens River. Historically, that valley is significant. Fremont's explorers passed through it in 1846. Richard Owen, at one time, was senior captain of the battalion under Fremont.[3] The river which bears his name has played an important role in the history of Los Angeles. William Mulholland, as chief engineer, presented a plan whereby the waters of Owens River would no longer drain into a saline sink but would be conveyed to Los Angeles in a huge aqueduct. The first bond issue of $1,500,000 needed to purchase rights-of-way and start preliminary work, was submitted

---

[2] Don J. Kinsey, The Romance of Water and Power, 19-20.

[3] Cardinal Goodwin, John Charles Fremont, 139.

to the people on September 7, 1905. The vote in favor of the bond issue was in the ratio of 15 to 1.[4]

Assured of a water supply adequate for a population of 2,000,000, the people, by a vote of 10 to 1, declared for the bonding of the city to the amount of $23,000,000 for the building of a municipal water system.[5] From the intake on Owens River, 250 miles north of Los Angeles, to its terminus inside the city limits, the aqueduct dropped from an elevation of 3,800 feet to 800 feet.[6] To the city engineers this, of course, suggested water power. A report in favor of utilizing the aqueduct for power purposes was made as early as 1906.[7] It was no accident, therefore, that the precious water raced along this specific course.

Other power schemes were presented to the people of Los

---

[4] From records of "Election Statistics" prepared by Mr. Torgersen, election supervisor of the City Clerk's Office, Los Angeles.

[5] Journal of Electricity, XVIII (June, 1907), 494.

[6] H. S. Raushenbush and Harry W. Laidler, Power Control, 170.

[7] Robert G. Cleland and Osgood Hardy, March of Industry, 220. C. G. Scattergood, "Letter to Editor on Distribution Problem," Journal of Electricity, XXX(January, 1912), 118, stated: "The fact is that some of the larger power interests investigated Owens Valley before the city's advent, and failed to become interested in it, and it was not until William Mulholland, chief engineer of the city's water department, failing to find an adequate water supply nearer than Owens Valley, made his investigation, and by careful observation and study saw the opportunities which, in the minds of others, did not exist."

Angeles. There was even a proposition advanced during the same year of the above report that the city might utilize the power that could be derived from the fall of the sewer water for the purpose of running a municipal lighting plant. The cost of the installation, as proposed, was estimated at $45,000.[8] There was also organized the Los Angeles Wave Power and Electric Company in 1907. This organization asked permission to erect a 700-foot pier at Redondo, where the waves of the ocean could be transformed into power for the city's use.[9] These two schemes were discarded, eventually, due to lack of support.

Almost ingeniously, the city engineers solved the enormous problems of the aqueduct. Machinery had to be selected; surveys conducted over deserts and through mountains. Power for driving the many diversion tunnels had to be supplied. Temporary power lines, 448 miles long, were built to carry electric energy to aqueduct camps. To provide this electric energy, plants were constructed at Division Creek No. 1 in Owens Valley and at Cottonwood Creek, directly opposite from Owens Lake. These plants went into operation in 1908.[10] Division Creek No. 1 was a temporary installation, but the

---

[8] Journal of Electricity, XVII (September, 1906), 250.

[9] Ibid., XIX (July, 1907), 81.

[10] Fowler, Hydroelectric Systems, 736-40.

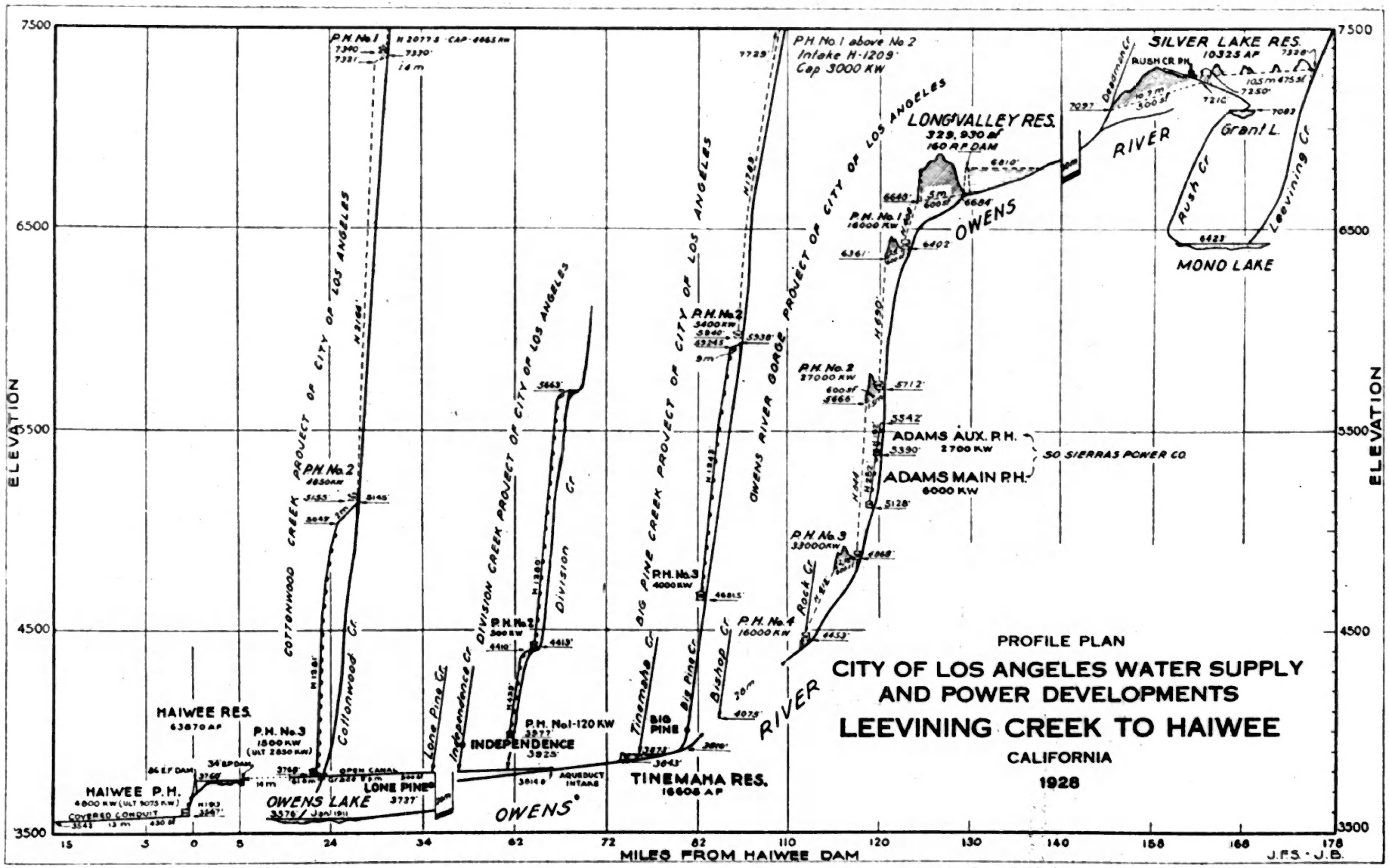
Cottonwood Creek generating station was to become a part of the permanent system of the Bureau of Power and Light. The first step towards municipal electric power was taken in 1909 by the city council when it approved the recommendation of the Board of Public Works that $10,000 be set aside from general taxes for each of the next two years to pay the cost of the preliminary work of establishing power plants along the line of the aqueduct.[11] This action was more than supported through the vote of the people on March 4, 1910, at which election $3,000,000 in bonds were voted for the construction of the first step in power development.[12]

Not without opposition had Los Angeles infiltrated into a section far from its city limits. The many streams emptying into Owens River, together with their watersheds and valleys, had been surveyed and coveted by other interests. Ranchers and even corporate towns faced a serious water shortage and certain stagnation in the diversion of their precious waters. Powerful interests looked unkindly upon what they considered "infringement of rights." The Southern Sierras Power Company had secured an interest in the Mono Power Company, with its water rights on the Owens River, and in the Silver Lake Power and Irrigation Company. In 1909 actual hostilities had commenced

---

[11] Journal of Electricity, XXIII (July, 1909), 105.

[12] Torgersen, "Election Statistics," City Clerk's Office, Los Angeles.



WATER POWERS OF CALIFORNIA PLATE 58

in the Owens River Valley between the representatives of the City of Los Angeles and The Southern Sierras Power Company.[13] This proved to be only the beginning of a long fight which culminated in Supreme Court action, as will be developed later.

As the prospect of hydroelectric power began to materialize, the organization of city departments and plans for the distribution of municipal energy grew proportionately. During the autumn of 1912 the city council began negotiations with the Los Angeles Gas and Electric, Pacific Light and Power Corporation, and Southern California Edison Company with the view to arranging for the purchase of their systems within the city.[14] The Bureau of Power and Light was officially established as a separate municipal bureau in 1913, and Mr. Scattergood at the same time was made its chief electrical engineer. Prior to that time the preliminary work of hydroelectric development was carried on as a part of the aqueduct project.[15] Confident of its future and determined to overcome and combat opposing interests, the city began an energy selling campaign. Cities, adjacent or near Los Angeles, were solicited.[16] This action constituted a direct threat to the private power

---

[13] Potter, Sierras Service Bulletin, July, 1935.

[14] Fowler, Hydroelectric Systems, 728.

[15] Kinsey, Romance of Water and Power, 14.

[16] Burt A. Heinly, "Los Angeles Power Bond Election on May 8," Engineering News, LXXI (April, 1914), 986-7.

interests. Not willing to relinquish power loads which they had built up through hard efforts these interests proposed to take over power developed from the aqueduct, from 35,000 horsepower upward, and offered $1,000,000 per year for this surplus hydroelectric power. No decisive action was taken at this time because the Bureau of Power and Light had offered a previous proposal to lease the substations and distributing systems of the companies for five years with an option to buy these essentials at the expiration period.

The immensity of the task, together with the reluctance on the part of many influential citizens to embark upon such a tremendous undertaking would have discouraged less competent and efficient leaders, but the promoters of the aqueduct and its power producing possibilities were adamant. One of the many issues involved can best be expressed in the words of chief electrical engineer E. F. Scattergood:[17]

> It is true that the completion of the proposed hydroelectric power system of Los Angeles has been delayed something like two years owing to the opposition of private interests, who are unwilling to sell their existing systems to the city at a valuation made at this time by the Railroad Commission or otherwise.

Construction at San Francisquito plant No. 1 had to be suspended in part in January, 1914, for lack of funds, but on

---

[17] E. F. Scattergood, "Municipal Ownership of Water Works and Supply and of Hydroelectric Power Plants," Journal of Electricity, XXXIII (December, 1914), 581.

May 8th the people voted a bond issue of $6,500,000 for the completion of the plant and construction or acquisition of an electrical distribution system within the city.[18] The confidence of the people caused new hope, new vigor, and leaders of the metropolis pushed ahead eagerly.

Determined to force the issue with the private power interests, the city council rejected their final offer to buy all the city aqueduct power for $750,000 per annum. In the same year, electrical engineer Scattergood announced that the city had signed light and power contracts with sixty per cent of the consumers in the district north of East Main Street and east of the Los Angeles River.[19] Then, on March 30, 1916, a great event took place at the corner of Piedmont Street and Pasadena Avenue (now North Figueroa Street) where a small crowd had gathered to witness the event[20] when the first pole was set in a distribution network that was destined to grow to first rank among municipal utilities in the United States. Unable yet to furnish prospective consumers with its own hydroelectric power, Los Angeles purchased energy from the Pasadena municipal system for distribution. And on April 10,

---

[18] Torgersen, "Election Statistics," City Clerk's Office, Los Angeles.

[19] Journal of Electricity, XXXVI (March, 1916), 252.

[20] Department of Water and Power, Los Angeles, Intake, XIII, No. 10, p. 2.

1917, San Francisquito No. 1 went into operation;[21] it was the first city-owned hydroelectric plant to deliver energy to Los Angeles.

On January 21, 1913, the Los Angeles Times published a news item in which it said:[22]

> The City of Los Angeles finds its intentions of supplying itself with water from the Owens River Aqueduct comewhat interfered with by certain persons who have filed on water power rights, and Senator Leslie R. Hewitt introduced a bill today which is designed to put an end to their activities. It provides that power generated from streams within the State must be sold only within the State. The men who vex the peace of mind of Los Angeles sell their power in Nevada and have no market for it elsewhere.

This action proved not as easy as contemplated. It was during the year 1912 that the Department of the Interior denied the application of the Silver Lake Power and Irrigation Company to develop its water rights in the Owens River Gorge and entered an order allowing the sale to the city of Los Angeles of certain lands upon which the Silver Lake Company desired to construct a power plant. Under the policy of conservation millions of acres had been added to the Forest Reserve. Such lands given over to the Department of Agriculture were subjects of disputes. Decisions were rendered without legal foundation. The laws of both the State of California and of

---

[21] Bureau of Power and Light, Los Angeles, Power for Los Angeles, 1940.

[22] Los Angeles, Times, January 21, 1913.

the United States gave to the Silver Lake Company vested rights to the use of the waters of Bishop Creek and the public lands adjacent thereto for the construction of its plants and works, before the land occupied by the power company had become a part of the Forest Reserve, and before the Department of Agriculture had obtained any jurisdiction over same.[23] In a condemnation suit against The Southern Sierras Power Company the city of Los Angeles secured a decree of condemnation from the Federal Court holding that the city as a municipality had the power and right to so condemn and take over this property. In reviewing the case one of the power company's lawyers remarked:[24]

> The power company appealed from this judgment and prosecuted a Writ of error to the United States Circuit Court of Appeals at San Francisco, where the matter was argued and submitted on February 27, 1922. In November of the same year the Appellate Court filed its decision in favor of The Southern Sierras Power Company, reversing the judgment of the Trial Court, and with direction to dismiss the Complaint of the City of Los Angeles. Later the City, on December 26, 1922 filed its petition for a rehearing and reargument before the Circuit Court of Appeals. This petition was denied. The case was then taken to the Supreme Court of the United States upon application for a Writ of Certiorari. This was denied and the Supreme Court of the United States refusing to review the record, a final Decree was entered in favor of The Southern Sierras Power Company.

After the first hydroelectric energy had reached Los Angeles, however, its engineers were jubilant at the successful

---

[23] Potter, Sierras Service Bulletin, June, 1936.

[24] Ibid., August, 1939.

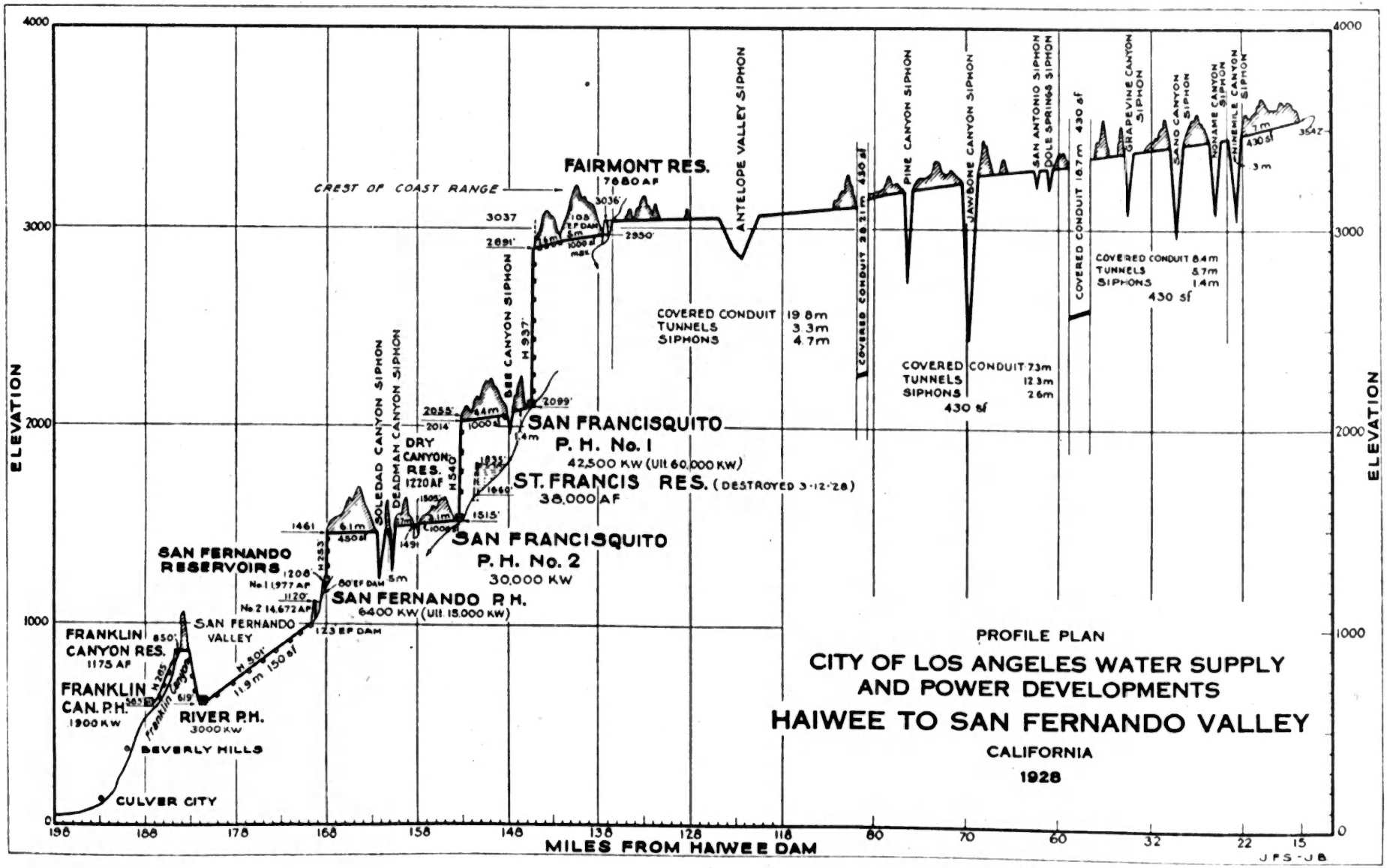
termination of a scheme many had branded as an idle dream. Setbacks were to be expected; obstacles could be overcome with diligence. And as cheaper power surged through copper conductors from this first plant, the demand for still larger quantities of electrical energy grew from an accumulating number of industrial and domestic consumers. In June of 1919, a bond issue of $13,500,000 was submitted to the voters and was authorized by an overwhelming majority. Proceeds from this issue were to be used for the purchase by the city of the electrical distribution system in Los Angeles of the Southern California Edison Company, and for the building of the second power plant, to be known as San Francisquito plant No. 2.[25] While the sale of these bonds was tied up in litigation, San Francisquito No. 2 was started from the Bureau's own revenues. It was paramount that its completion be rushed because of a threatened crippling power shortage due to low rainfall conditions, 1919-20. San Francisquito plant No. 2 was completed and placed in operation in July, 1920.[26] Just prior to this time a small hydro electric plant had been constructed in San Fernando Valley.[27]

---

[25] Torgersen, "Election Statistics," City Clerk's Office, Los Angeles.

[26] Fowler, Hydroelectric Systems, 731.

[27] Ibid., 757. River plant was added in order to utilize, when it was not necessary to deliver water to Franklin Reservoir, the head available between San Fernando Reservoir and the lowest point on the siphon. The power house is at the point where the siphon crosses Los Angeles River.



WATER POWERS OF CALIFORNIA PLATE 59

Expansion became the keynote of the Bureau's policies. Pasadena officials voted to accept the Bureau's bid to supply electrical energy to that city at wholesale prices for a term of fifteen years. Determined also that the most extensive limits should succumb to its monopoly the city threatened reprisals against private interests. The Harbor Commission threatened to cut down private lines crossing over tide lands under their control.[28] In 1920 Los Angeles startled those interested in hydroelectric development by making an application to the California State Water Commission covering practically all the water power sites remaining available in the southern portion of the state. This application reached prospective water sources as far north as Tuolumne River. At the same time it was announced that city officials had been in conference with Arthur P. Davis, director of the United States Reclamation Service, outlining a program for the development of municipal hydroelectric power in conjunction with a gigantic government scheme for reclamation of desert lands. This discussion included the joint undertaking by the United States government and the city of Los Angeles of impounding of

---

[28] Journal of Electricity, XL (June, 1918), 375, states: "Twenty private power lines crossing tide lands under the control of the Harbor Commission will be cut down to prevent competition with municipal power, unless the private corporations retire from the field, according to the decision of the Harbor Commission."

hundreds of acres of water from the Colorado River and the Mono watershed.[29] These plans caused serious concern to numerous power companies. They questioned the right of a municipality to engage in wholesale distribution of power outside its corporate limits.

With the completion of the Franklin Canyon plant, June 3, 1921, all available hydroelectric power from the aqueduct was realized. This particular generating station, located north of the town of Beverly Hills, is only eleven miles west of the business section of Los Angeles.[30] Having the supply of energy available, it was only natural that herculean efforts should be made to secure its efficient distribution. Power bonds which had been held in litigation were sold in 1922 and, as the problems of valuation and severance with the Southern California Edison had been compromised, Los Angeles took over the electrical distributing system of the Edison interests. Following this purchase the municipal system had a total of 130,000 customers. In the next five years it added 100,000 more or 20,000 customers per year.[31]

Phenomenal industrial growth challenged the electrical

---

[29] Journal of Electricity, XLV (July -December, 1920), 154-590.

[30] Fowler, Hydroelectric Systems, 759.

[31] Raushenbush and Laidler, Power Control, 172-73.

capacity of not only the city's plants but those of the power giants. New sources were eagerly sought, and it was only through government aid and cooperation that monstrous hydroelectric projects were developed. As has already been mentioned Los Angeles had launched itself upon an ambitious program. She had filed on 292,250 theoretical horsepower on the Middle and South forks of Kings River and the main river below the junction with the intention of holding these filings to assure itself of an adequate power supply.[32] Progress was being made in plants located on Owens River. Nevertheless, with an energy sale increase in less than a decade from 88,000,000 kilowatt hours in 1917 to 471,000,000 kilowatt hours in 1925,[33] city officials realized that "White Gold" had built their metropolis; its future life depended upon an unlimited supply of energy.

Suddenly, disaster struck the hydroelectric system of Los Angeles. Through failure of the St. Francis dam at midnight March 12, 1928, San Francisquito No. 2 was completely demolished. A loss of approximately $2,000,000 was thus sustained.[34] Besides this damage two other plants were put out of commission; three serious breaks in the aqueduct system

---

[32] Fowler, Hydroelectric Systems, 735.

[33] Kinsey, Romance of Water and Power, 27.

[34] Electrical West, LX (April, 1928), 190.

resulted; two 110-kv. transmission lines and two 220-kv. transmission lines were washed out. In spite of such a catastrophe the entire city load was carried by the system of the Southern California Edison Company with which the city system is interconnected. San Francisquito No. 2 was rebuilt on the exact location of the old plant.[35]

It was only natural that in time investigations led to the greatest source of hydroelectric supply--the Colorado River. This river has a length of 1750 miles. It rises in the mountains of Colorado and Wyoming, and flows down through these states and the states of Utah, Arizona, Nevada, and California, with tributaries crossing the boundary line of New Mexico.[36] Tremendous possibilities of storage, palpable under proper development, would guarantee needed hydroelectric power for years to come.[37] Numerous surveys were made and, after careful study, Boulder Canyon was selected as the proper

---

[35] Electrical West, LXI (July, 1928), 45.

[36] Raushenbush and Laidler, Power Control, 200.

[37] Frederick H. Fowler, "Power Possibilities in Southern California," Journal of Electricity, XLI (November, 1918), 395: "On the south side of the San Gabriel and San Bernardino mountains eastward of Los Angeles, the small power streams are already pretty thoroughly developed by some of the minor plants of our California hydroelectric system. Future possibilities in this region are not very important, since these are days of large units, operated in connection with considerable amounts of storage. The Southern California streams are mostly small, with only limited opportunities for development of storage."

location for the structure which would impound the water of the turbulent Colorado. When the United States Reclamation Service submitted its report to the Department of Interior on the problems of the Colorado River, in 1922, it recommended the construction by the Federal government of two major projects: the building of an All-American Canal to Imperial and Coachella Valleys, and a 550-foot dam across the Colorado River in Boulder Canyon.[38] When Secretary Work presented his suggestions on the proposed Boulder Canyon Project Act, he recommended that the bill provide, not only for a dam at Boulder Canyon, but also for the construction and operation by the Federal government of a hydroelectric generating plant at the dam site.[39]

These developments on the Colorado River were made possible through adoption by Congress of the Boulder Canyon Project Act in 1928.[40] The story of Boulder Dam in its relation to hydroelectric development and Southern California is told in Chapter VI of this study. The part, however, played by Los Angeles in the conception and final culmination of this gigantic project cannot be minimized. When one surveys the industrial section of Los Angeles with its smokeless

---

[38] Kinsey, Romance of Water and Power, 31.

[39] Ibid., 32.

[40] "Boulder Canyon Project Act," Shepard's Citations; Table of Federal Acts, 1011.

skies, it is evident that a metropolis has catapulted into greatness. That position of prominence was not a gift from heaven that was sent to vivify the torpid Spanish pueblo as founded by Felipe de Neve; it was the untiring efforts of men of vision and intelligence that brought to Los Angeles water and its powerful companion--hydroelectric energy.

TABLE IV

HYDRO PLANTS INSTALLED BY THE CITY OF LOS ANGELES

Plant	Year
Division Creek No. 1	1908
Cottonwood Creek No. 1	1908
Cottonwood Creek No. 1	1909
Division Creek No. 2	1909
San Francisquito No. 1	1917
San Francisquito No. 1	1923
River Plant	1917
Haiwee	1919
Haiwee	1927
San Francisquito No. 2	1920
San Francisquito No. 2	1928
Franklin Canyon	1922
Big Pine	1925

CHAPTER V

ELECTRIC POWER DEVELOPMENT IN IMPERIAL VALLEY

Because of its unique position in the history of California, both topographically and economically, the Colorado Desert deserves special consideration. Two valleys, Imperial and Coachella, comprise a vast area of this territory, some ninety miles across from the San Gorgonio Pass in the San Jacinto mountains to the Colorado at Yuma, and more than one hundred miles long from the Mexican boundary line to Indio. There are many evidences that this huge land bowl was once under water. Even the casual observer wonders about the ancient water mark plainly imprinted upon the rock walls high above the sandy floot. The basin was first named the Conchilla--from the Spanish concha, a shell, diminutive, conchilla-because of the myriads of little shells found here mingled with some of larger size, relics of the brackish lake which long filled this great depression.[1] And when the white man first visited this land only the dry, salt-encrusted soil remained, mute evidence of the geological past.

Imperial Valley, home of the Salton Sea, lies in Imperial County. This county is 84 miles long from east to west and 54 miles from north to south and has an area of

---

[1] Aubrey Drury, California, An Enchanted Land, 131.

4,536 square miles or about 2,600,000 acres.[2] Salton Sea is about 250 feet below sea-level and once occupied the greater part of the two valleys.[3] Today, only a miniature lake remains; and around it is rich soil impregnated with verdant growth. Only because of the dreams of man and his iron will has this become possible, a desert turned into a tropical paradise.

At the time when the American colonies were struggling for freedom from the mother country, the Spanish were desirous of securing an overland connection from Mexico to their missions and settlements in Alta California. An Indian fighter, Juan Bautista de Anza, was chosen to explore a route from Sonora. In January, 1774, Anza set out from Tubac with a band of thirty-four men on this epoch-making adventure, the first crossing of the mountains into California by white men, through a pass in the San Jacinto Mountains, a southern spur of the Sierra, coming out at Hemet.[4] There were no dry stages in the desert then. It was all one dry stage--a race for life from the Colorado's bank northwesterly to the first water at San Felipe or Vallecitos. This was a 90-mile jornada without water or shade, across a flat, treeless plain of hard

---

[2] The Encyclopedia Americana, XIV, 723.

[3] Drury, California, 134.

[4] Rockwell D. Hunt and Nellie Van de Grift Sanchez, A Short History of California, 105.

clay-like soil or burning sands.[5]

Then, from out of the east there came a new brand of men who spoke a strange language, restless souls, filled with curiosity and in search of adventure. After 1825 there are records of several visits being made to the Colorado's lower basin and the Salton Sink by trappers from the Middle West. Among these were Ewing Young, Sylvester Pattie and James Ohio Pattie. The trails of these pioneers were traced by other men who investigated the barren waste. The ceding of vast territory to the United States at the termination of the Mexican War, and the discovery of gold in California, brought hordes of settlers to the West. One of these early pioneers to San Bernardino, Dr. Oliver M. Wozencraft, discovered in 1849 that water could be brought to the floor of the Colorado Desert by gravity; because almost the whole of what is now Imperial Valley is below the level of the ocean, as well as of the Colorado, still riding along the alluvial ridge of its own creation.[6]

Thus it was that in 1856 Dr. Wozencraft came to the front and applied to Congress for a land title for himself and his associates if they would reclaim the lands. The application was received, and the Committee on Public Lands

---

[5] J. A. Alexander, Life of George Chaffey, 272-73.

[6] Ibid., 277.

reported in favor of the concession;[7] but the Civil War drove the attention of the nation away from such projects, and Dr. Wozencraft's venture fell into decay. Before his death, however, the doctor had influenced the mind of George Chaffey, the founder of the Ontario Power Company. Although the latter had to spend eleven years at Mildura, Australia, in order to be convinced that not only vegetation, but human beings of Anglo-Saxon stock, throve under conditions of intense dry heat. Thus, when Imperial Valley needed her "Great Man," George Chaffey came forth to put his experience and brains into a project which was carried along on the ideas of Dr. Wozencraft. It seemed doomed to failure, however, under men who had neither the foresight nor the ambition for such an undertaking. The California Development Company had been formed by other men who appealed to George Chaffey. In 1900 he was the one man with financial backing who could be found to put money into what was still considered a fantastic proposition.[8]

Andrew Chaffey, a Los Angeles banker, urged his father not to have anything to do with the California Development Company. But George Chaffey had made a detailed examination of the project in 1899, and he was convinced that here was the greatest opportunity for irrigation ever presented to

---

[7] Finis C. Farr, The History of Imperial County, California, 3.

[8] Alexander, George Chaffey, 270.

the American people.[9] So George Chaffey responded to his son's protest: "Let me do one more big thing before I die."[10]

Little wonder was it that financiers had fought shy of a project which carried such words as "Desert" and "Salton Sink." But George Chaffey accomplished for about $100,000 a work presenting more unusual features than any irrigation project undertaken in modern times, and originally estimated to cost $1,000,000.[11] It was a miracle in their own time, because two years after the contract with the California Development Company was signed, the main channel had been completed, 400 miles of irrigating ditches had been dug, and home seekers were pouring in with the yellow waters of the Colorado on to the desert's dusty face. The water was turned through the Chaffey Gate at the Hanlon Heading on May 14, 1901.[12] Men seemed eager to buy up the sandy soil. Visions of the future were exemplified by the actions of these first pioneers.

The history of Imperial Valley is inseparably linked with that of W. F. Holt. He was the earliest "capitalist" outside of the California Development group to see the future

---

[9] Alexander, George Chaffey, 284.

[10] Loc. cit.,

[11] Ibid., 290.

[12] Ibid., 291.

of the broad valley called Imperial.[13] In 1901, Mr. Holt conceived the idea of dropping an extra canal of water to the bottom of the Alamo River, some forty feet to produce electric power. The ultimate result of this thought was the Holton Power Company, which furnished light and power to the entire valley.[14] The company was incorporated September 16, 1903, for a period of fifty years. The principal place of business of the company until May, 1916, was at Redlands, California. The first plant was completed in 1905. This was a low head turbine installation, a 450-h.p. turbine and 335-h.p. generator, housed in a brick building. W. F. Holt's company was first known as the Holton Town and Power Company--later changed to Holton Power Company.[15] The power plant idea called for a town on the east side of the river bed. Mr. Holt platted Holton, which soon was changed to Holtville.[16]

This was not, however, the pioneer generating station in the Valley. The first electrical installation was a small, single phase plant in the town of Imperial. A local company, known as the Imperial Light, Water and Power Company, provided the first electric lighting August 20, 1904. An oil-burning

---

[13] Otis B. Tout, The First Thirty Years, 1901-1931, 53.

[14] Ibid., 54.

[15] Ibid., 398.

[16] Potter, Sierras Service Bulletin, October, 1936.

engine was used to drive a dynamo. The rate was $1.00 per lamp, per month, or twenty-five cents a kilowatt, the customer to install the meter.[17] Its lighting plant and small ice plant were purchased and taken over by W. F. Holt in December, 1904, for the sum of $35,000. And in July, 1905, both of these plants went out of commission on account of the heat, when the thermometer reached 115 degrees.[18] But with a more stable supply of power from the Holton Power Company, a notation appeared in a local newspaper in 1906:[19] "The coming of the first moving pictures is announced at the Water Company hall."

The Colorado River, creator of life in Imperial Valley, proved that it could destroy as well as create when it cut through its banks in 1905. After threatening to destroy all that man had accomplished, it was tamed in 1907 only after a most spectacular fight by the Southern Pacific Railroad. During the river's mad diversion, shortage of water in the canal caused vexatious interruptions in electric service all over the Valley. This historic break, however, had cut the Alamo Channel about 20 feet deeper; and this additional drop was utilized by a second low head plant, of 1150 h.p. capacity

---

[17]Tout, The First Thirty Years, 175.

[18]Potter, Sierras Service Bulletin, November, 1936.

[19]Tout, op. cit., 179.

which was built below the original plant.[20] Transmission lines were constructed to Calexico, Imperial, El Centro, and Brawley. Most of the line construction was completed in 1907.

Convinced that the territory's growth demanded an unfailing supply of electric energy, W. F. Holt installed an auxiliary steam plant at El Centro. This was supplemented a few years later by a gas engine generating plant, of 1000 h.p. rated capacity, which went on the line in 1912.[21] Population growth in the Valley at this time necessitated such developments. Although the census figures show that the population had actually receded during the two years of flood menace, restoration of confidence was plainly shown by later influxes of immigrants. At the beginning of 1907 there were approximately 7500 people in the Valley. Within two years there were 15,000.[22]

In a country where the average rainfall is less than two inches per year, and where official temperatures are occasionally recorded as high as 115 degrees Fahrenheit and show a mean humidity of about 35 degrees, machinery as well as human beings often proves inadequate. It was not realized at the outset, nor indeed, until costly and exasperating

---

[20] Tout, The First Thirty Years, 180.

[21] Ibid., 398.

[22] Ibid., 190.

experiences brought home the truth that the climate, topographic and hydrographic peculiarities of the Valley, while making it the winter garden of America, with gravity irrigation and waste water disposal naturally provided, entailed problems of electrical generation, domestic water supply, and ice manufacture that would require the investment of millions to solve. Great progress had been made, but industrial demands were growing so imperative that unless they were met, the prosperity of the whole territory would be checked, and development halted in mid-stride. With a rapid increase in demand and almost equal falling off in plant efficiency, electrical service in the Valley went from bad to worse. The intakes and drops of the low head hydroplants silted up, and the same silt cut the runners of the turbines as though ground on an emery wheel.[23]

In 1914, owing to the increased demand for electricity in the Imperial Valley, it became imperative for the Holton Power Company either to increase its generating capacity by the construction of new generating plants in the Valley, or else to connect with other companies who had a surplus of power to sell.[24] In 1911 Mr. Holt and his associates had incorporated Coachella Valley Ice and Electric Company, a

---

[23] Tout, The First Thirty Years, 398.

[24] Farr, History of Imperial County, 283.

cold-storage and electric system to operate in Coachella Valleyonn the main line of the Southern Pacific between Banning and Indio.[25] It was proposed that these Holt enterprises enter into contract with The Southern Sierras Power Company for the purchase of power. In December, 1913, the Railroad Commission of California approved such contracts and authorized the construction of a 55,000 volt, 3 phase, 60 cycle transmission line from the San Bernardino Steam Plant to the city of Banning, and also the construction of a similar line from Banning to Imperial Junction, there to connect with the electrical system of the Holton Power Company, thereby providing for electric lights and power through the entire Imperial and Coachella Valleys, generated and delivered by The Southern Sierras Power Company.[26]

During the early months of 1914, the engineering and construction forces were at work, and the new transmission line and many of the service connections were completed. On August 13, 1914, the line was energized and an abundance of electricity was delivered to these Valleys by The Southern Sierras Power Company.[27] At the time of its connection this was the longest power transmission line in the world, from

---

[25] Fowler, Hydroelectric Systems, 824.

[26] Potter, Sierras Service Bulletin, July, 1936.

[27] Ibid., September, 1936.

Bishop, California, to the Mexican Border. At this time the total load in Coachella Valley was light; in 1916, it had a connected load of 850 electrical h.p., with an additional 60 h.p. ready to be installed.[28] With an unlimited supply of electric power at hand, however, new life blood flowed into the industrial veins of the territory. Additional lines reached out toward distant points. One of the most interesting pieces of work carried on during the year 1917 was the construction of the transmission line to Hanlon Heading on the Colorado River, for use at that point, and to connect with Yuma, Arizona.[29] During this same year The Southern Sierras Power Company secured a fifty-year franchise authorizing them to operate in a territory adjacent to the Imperial Valley. In 1917 this company placed a diesel engine in operation in the city of Blythe to supply that city and community with electricity.

With the assurance of electric energy, new crops were added to the lists of Imperial County products. Machinery and plants worked incessantly with few power interruptions. Prosperity and industrial activity are possible only with an adequate supply of electric power. Any industrial district, however, demands much from its electric source. There must

---

[28] Potter, Sierras Service Bulletin, October, 1937.

[29] Ibid., March, 1938.

be not only an adequate supply at all times but also a source nearly free from interruptions. And toward these features the company supplying Imperial Valley and its adjacent territories has struggled successfully. In 1923 an important contract was signed between The Southern Sierras Power Company and the San Diego Consolidated Gas and Electric Company. This contract provided for emergency service to be rendered by either company. It also provided for the sale of surplus power by either company to the other, and required the construction of a transmission line 88 miles long between El Centro and Rincon, at which point connection was to be made with the lines of the San Diego company.[30] This same year witnessed the complete consolidation of the Holton Power Company and its electric business in the Imperial Valley with The Southern Sierras Power Company. Such attempts to serve the territory as fully as possible attested to the great efforts of the power company; and in 1935, there were 447 miles of pole lines in the two valleys, Imperial and Coachella. In Coachella Valley 95 per cent of the inhabited farm residences were then served; and in Imperial Valley, where there are no power demands for pumping water, 25 per cent.[31]

The Southern Sierras Power Company has identified

---

[30]Potter, Sierras Service Bulletin, February, 1940.

[31]Ibid., May, 1935.

itself with the Imperial Valley, proudly and whole-heartedly. It has steadily improved service and reduced rates until both are now on a metropolitan level, the one in dependability, the other in economy, and the process is still going on in both directions, upward in efficiency and downward in cost.[32] Repeated reductions in rate schedules have been made so that service is rendered today at rates approximately 40 per cent less than those in effect in 1916, and a rapid expansion in business involving an increase in energy distributed annually in the two valleys from 13,700,000 kw-hours in 1917 to 51,800,000 kw. hours in 1934.[33]

Agitation for municipal ownership of lines and equipment of utility companies has been a part of the vicissitudes of the residents of sections of this district. In 1927 the city of Brawley contemplated such action. Talk of the city producing electricity for municipal use was started when the council, in October, by resolution, instructed City Engineer G. R. Wade to find the cost of installation of a plant. Reports were made and a plan was formulated and presented to the voters. In May, 1931, the proposal to establish a city electric plant at a cost of $150,000 failed to receive the necessary support at the polls.[34] Perhaps some of this agitation was caused by the

---

[32]Tout, The First Thirty Years, 398.

[33]Potter, Sierras Service Bulletin, May, 1935.

[34]Tout, op. cit., 302.

preliminary report of the All-American Canal Board of 1918. That report specified that:[35]

> On the All-American Canal at two points fall can be concentrated and power should be developed. The plants at these points will be referred to as Power Plants Nos. 1 and 2. The installation should be for utilization of 6,000 second-feet falling about 30 feet at the first station, and 5,500 second-feet falling about 47 feet at the second station.

The total cost of constructing the All-American Canal as described in Mr. Preston's report at a capacity of 9,000 second-feet, not including the two power plants on the mesa was estimated at $26,732,602. The estimated cost of the two power plants was $3,754,014.[36] Today, the lines of the District, fed from these power plants, parallel the lines of the California Electric Power Company, which formerly owned The Southern Sierras Power Company, with each competing for customers.

The story of Boulder Dam and the hydroelectric development along the All-American Canal are expanded in the following chapter. The San Gorgonio developments have already been described under power contracts of The Southern Sierras Power Company. And before leaving this particular section of hydroelectric history the only remaining project belonging here is the small plant called the Yuma project

---

[35] Porter J. Preston, Preliminary Report of the All-American Canal Board, 3.

[36] Loc. cit.

of the United States Bureau of Reclamation. It was placed in operation August 26, 1926.[37] The plant was constructed on the main irrigation canal near Yuma on the California side. The two San Gorgonio plants and the Yuma plant were the only hydro-electric developments existing in the Salton Sink locality during this period of our history.[38]

Imperial Valley and its adjacent territory stand today secure from a repetition of the disastrous Colorado flood of 1906. With the completion of the All-American Canal an abundance of water is secured. This giver of life, combined with a reservoir of electric energy moving tirelessly over the copper ribbons insures the future of this section. Many such sections have been partially man-made. But the most conspicuous example of readjustment wrought by reclamation and irrigation, affording actual demonstration of sheer results accomplished, is found in the transformation of the great Colorado Desert into the opulent Imperial Valley. This vast arid region, virtually without rainfall, has become a garden spot for multitudes, pouring out undreamed-of treasure.[39] In this transformation electric energy has opened the vaults of wealth and comfort.

---

[37] Bonner, Report to the Federal Power Commission, 190.

[38] Ibid., 168.

[39] Hunt and Sanchez, A Short History of California, 613.

Air-conditioning and refrigeration have made of a burning bowl of sand a tropical paradise. And in contrast to its guarantee of comfort, electricity challenges the ponderous wheels of industry and agriculture to increase their tempo for a much higher standard of living.

CHAPTER VI

FROM OUT OF THE EAST

When viewed from the standpoint of topography, Southern California's contributions to the vital hydroelectric industry have been stupendous. By Southern California we mean that section of the state south of the Tehachapi Mountains.[1] Several of its streams have steep grades and a fairly large average yield; nevertheless, the extremely erratic flow and the lack of favorable reservoir sites in the steep upper basins limited the potential hydroelectric generation to the comparatively small plants already constructed and described.[2] Use of electric energy, however, made demand the driving master of necessity. Power is life itself to this section and, as industry threatened to drain the reserve of the utilities, business differences had been tossed aside in order that a constant stream of new energy could be forced into the electric arteries of the Southland.

Boulder Dam on the mighty Colorado River has been built upon such cooperation and sacrifice of the municipalities and private utilities of this section. Great credit must be accorded their efforts; because great have been the social

---

[1] Bonner, Report to the Federal Power Commission, 163.

[2] Ibid., 164.

values gained. Secretary Wilbur officially began the construction of the huge dam on September 17, 1930, near Las Vegas, Nevada.[3] Under a government contract The Southern Sierras Power Company constructed a steel tower line from San Bernardino to Boulder City. June 25, 1931, was the memorable date for officially starting the delivery of power.[4] This Southern Sierras line placed 40,000 horsepower at the disposal of the Six Companies, Inc., which had started actual construction on March 11.[5] Southern California's transmission of hydroelectric energy, therefore, supplied the power for a project which was in turn to be so beneficial to this part of the West. The market for the energy from Boulder Dam seemed limited to this section as this excerpt from the Electrical West indicates:[6]

> From the standpoint of present economies, the only conceivable market of sufficient magnitude within any reasonable transmission distance of Boulder Dam is in Southern California. Surveys in that area show that in 1929 the electric power consumption was 4,660,000,000 kw.-hr.

Alive to the possibilities of cheap power, Southern California cities participated in elections to test the desires of their citizens. On September 29, 1931, Glendale, Burbank, and Pasadena, in addition to giving large majorities for the

---

[3] Electrical West, ed., LXV (October, 1930), 163.

[4] Sierras Service Bulletin, July, 1938.

[5] Intake, XIII, No. 10, p. 4.

[6] Electrical West, LXIV (June, 1930), 614.

$220,000,000 Metropolitan Water District bond issue, each voted to enter into fifty-year contracts with the Federal government for electric energy to be generated at Boulder Dam and with the Los Angeles Department of Water and Power for transmission of the energy to their respective cities.[7] Then, when the United States Supreme Court dismissed Arizona's suit for an injunction which sought to halt work on the project, Boulder Dam hydroelectric energy was assured.

Energetically, men fought the problems of transmission. Before great amounts of power could be brought to Los Angeles and vicinity, engineers of the Bureau of Power and Light conducted exhaustive research in the largest electrical laboratories in the nation. Tower designs, insulator protection from flashovers, high voltage disconnecting switches, circuit breaker innovations, transformer and generator experimentations were only a few of the scientific research problems.[8] Ordinary methods of financing such a line were interrupted by the business depression, but the money needed for construction of the Boulder Transmission System was secured through a $22,799,000 Reconstruction Finance Corporation loan.[9] Actual construction of the line, which ultimately consisted of 2695 steel towers,

---

[7] Electrical West, LXVII (May 1931), 252.

[8] Intake, XIII, No. 10, 8.

[9] Ibid., 6.

began early in June, 1933.[10]

With the depression and its consequent drop in fuel prices, steam-electric generation increased. Also, three succeeding dry years had contributed much to a further decrease in hydroelectric generation. Eleven western states including California showed in 1931:[11]

Hydroelectric Percentage in Western States

Year	Per Cent of Total Power
1927	88.9
1928	86.5
1929	77.7
1930	77.8
1931	67.5

Two hydroelectric transactions took place in Southern California during 1933 which shaped somewhat future developments for two municipalities. The Bureau of Power and Light gained possession of Mono Basin and Owens River Gorge properties and water rights of The Southern Sierras Power Company at a price ultimately agreed upon as $6,740,000.[12] The city of Pasadena purchased the historic Azusa plant and 1,000 acres of land from the Southern California Edison Company Ltd. for $783,494.[13]

---

[10] Intake, XIII, No. 10, p. 14

[11] Electrical West, LXVIII (February, 1932), 56.

[12] Ibid., LXXI (September, 1933), 39.

[13] Ibid., LXX (May, 1933), 170.

Superhuman effort, crushing all obstacles, finished construction of the dam at Boulder Canyon far ahead of schedule. President Franklin D. Roosevelt officially dedicated Boulder Dam on September 30, 1935.[14] All construction records were broken when the project was officially turned over to the United States by the Six Companies, Inc., on March 1, 1936. All work was completed on the dam, powerhouse and other pertinent structures except installation of the powerhouse machinery some two years and two months ahead of the schedule laid out originally.[15] The main features of the gigantic project can be seen in the accompanying illustration. And long before the project's completion, a transmission line from Los Angeles was being pushed towards delivery of energy. This line, completed in 1936, brought new hydroelectric history to Southern California. Mr. E. F. Scattergood reported:[16]

> It is believed that this line not only has established a new voltage step in the transmission of electric power on the North American continent, but also has served to stimulate advance in the art and science of electric power transmission and related electrical fields. It is a milestone of current progress.

This great system 266 miles long which delivers its current

---

[14] Bureau of Power and Light, Los Angeles, Boulder Canyon Project, 8.

[15] Electrical West, LXXVI (January, 1936), 52.

[16] E. F. Scattergood, "Engineering Features of the Boulder Dam--Los Angeles Lines and Some Features of the Boulder Canyon Project," reprinted from Electrical Engineering, April and May, 1935.

in Los Angeles at 275,000 volts is the highest voltage transmission network ever built.[17] And when, on October 9, 1936, the power of Boulder Dam reached Los Angeles, no more fitting tribute could have been made than this statement from the Los Angeles Examiner:[18]

> There was one dramatic moment that will live forever when the history of the Southwest is compiled for eternity. A girl, a slim and lovely figure, projected there before a multitude that walled the Civic Center with eager faces, pressed a golden key. Before that girl's eyes could twinkle with the thrill that held her in its sway Boulder Dam power came to Los Angeles. It was a scene that Jove himself might have had a hand in. The skies went mad with light; then reverberated with the roar of the crowd.

And with the coming of cheaper hydroelectric power came a banner year in the sale of energy for 1936 in Los Angeles.

Many different opinions resulted from the findings of the power survey of the Federal Power Commission. During the years 1935-36 the surveys disclosed many pertinent facts, not only regarding the holding companies and their subsidiaries but also the power developments and prospective hydroelectric sources. The survey of 1935 reported that were it not for the completion of the Boulder Canyon development by 1936, a definite shortage could be expected in this area.[19] With the

---

[17]Bureau of Power and Light, Los Angeles, Power for Los Angeles.

[18]James Lee, Los Angeles Examiner, October 10, 1936.

[19]Federal Power Commission, National Power Survey, Power Series, No. 1, p. 30.

advent of Boulder Dam power, however, the Southern California Edison released surplus energy to the San Joaquin Light and Power Company for use in Central California. Other agencies also took issue with the Commission on its shortage prospectus.

Another item in the survey demanded the attention of the citizens in Imperial Valley, for, besides recommending the construction of Bullshead Dam between Boulder and Parker Dam and citing the hydro plants which would ultimately rise at the Parker structure, the survey reported:[20]

> Power developments are contemplated in connection with the All-American Canal, now under construction in southern California, consisting of 6 plants with total capacity of 65,000 kilowatts.

This proposed development brought remonstrances not only from the private utility supplying the section but also from other sources protesting such use of government funds. Wyoming and Colorado, in addition to New Mexico, according to the Electrical West lodged disagreements:[21]

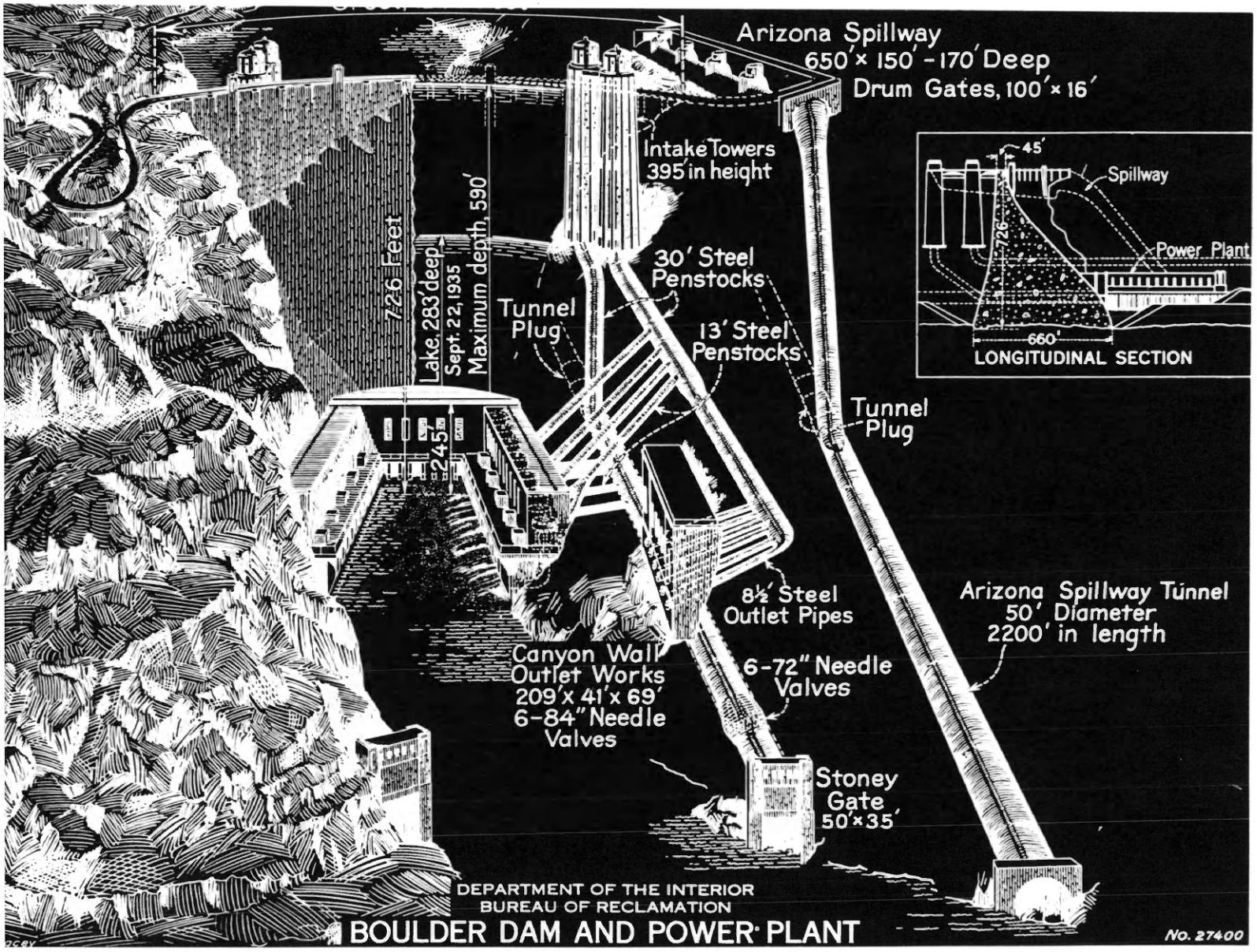
> Protests against the use of federal funds for power plants in the Imperial Valley which would undersell the Boulder Dam power plant will be lodged with Secretary of the Interior Harold Ickes by at least two states of the Colorado River basin.

Such complaints only served to delay hydroelectric developments.

---

[20] Federal Power Commission, National Power Survey, No. 1, p. 31

[21] Electrical West, LXXVII (October, 1936), 115.


Arizona Spillway
650' × 150' - 170' Deep
Drum Gates, 100' × 16'
Intake Towers
395' in height
726 Feet
Lake, 283' deep
Sept. 22, 1935
Maximum depth, 590'
30' Steel
Penstocks
Tunnel
Plug
13' Steel
Penstocks
Tunnel
Plug
245'
8½' Steel
Outlet Pipes
Arizona Spillway Tunnel
50' Diameter
2200' in length
Canyon Wall
Outlet Works
209' x 41' x 69'
6-84" Needle
Valves
6-72" Needle
Valves
Stoney
Gate
50' × 35'
45'
Spillway
726'
Power Plant
660'
LONGITUDINAL SECTION
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
BOULDER DAM AND POWER PLANT
No. 27400

Southern California did not escape the policy of mergers which swept the nation during this decade, as an excerpt from the Power Survey indicates:[22]

> In 1902 there were approximately 3,600 privately and publicly owned electric generating systems supplying the public. By 1917 they had grown in number to 6,500. The period of mergers and consolidations which followed the World War reversed this trend so that today there are approximately 1,600 privately owned and 1,900 municipally owned electric utilities operating in this country.

The merger and consolidation of the facilities of The Southern Sierras Power Company, The Nevada-California Power Company, and the Yuma Utilities Company, with the Nevada-California Electric Corporation was approved by the Federal Power Commission in 1936 1936.[23] And in December of the same year, the citizens of Los Angeles voted to purchase the electrical properties of the Los Angeles Gas and Electric Company.[24] The properties were turned over to the Bureau on February 1, 1937. The price, as previously fixed by agreement, was $46,340,000.[25] Through such mergers we find Southern California served by the private companies and municipalities as now with one exception; the Nevada-California Electric Corporation took the name of the California Electric

---

[22] Federal Power Commission, National Power Survey, No. 1, p. 6.

[23] Electrical West, LXXVI (June, 1936), 183.

[24] Torgersen, "Election Statistics," City Clerk's Office, Los Angeles.

[25] Electrical West, LXXVIII (January 1937), 60.

Power Company on July 1, 1941.

Hydroelectric development by the Imperial Irrigation District through Federal contracts was approved by the voters of the district in June, 1937, by a large majority. Accepted was the grant of $1,242,000 and a loan of $1,518,000 to build a power plant on the All-American Canal, construct transmission and distribution lines, and increase capacity in the Brawley diesel standby.[26] And although rise in fuel costs had caused inroads against hydroelectric generation by steam-electric units, the year 1936 saw a total hydro generation on the Edison system of 85 per cent of the power delivered.[27] This contribution to the greatest load in the Edison's history compared more than favorably with other increases in hydroelectric advancement throughout Southern California.

During 1937 Boulder Dam energy flowed into the growth of the Southland. The Bureau of Power and Light, the first allottee to take Boulder power, had four of its 115,000 horse-power units in service by March, 1937.[28] Fifteen such units had been provided for in the huge project, exclusive of many smaller units. A further advantage of the tie-in transmissions

---

[26] Electrical West, LXXIX (August, 1937), 55.

[27] W. L.Frost,"Edison System Tops High in All Records," Electrical West, LXXVIII (February, 1937), 63.

[28] Bureau of Power and Light, Boulder Canyon Project, 12.

resulted on September 15, 1937, when the Nevada-California started to serve its surplus Boulder Dam energy to the San Diego Consolidated Gas and Electric Company over the Rincon transmission line.[29] Hydroelectric power now flowed back to Southern California cities over the same conductors of the Nevada-California lines which had carried power to build the giant structure.

The story of transmission line construction over many Southern California routes occupied the spotlight during 1938. The Southern California Edison Company completed its 220,000 volt transmission line from Chino substation to Boulder Dam. The Metropolitan Water District had the enormous task of constructing 237 miles of transmission lines to carry its 36 per cent allotment of Boulder power to synchronous motors concentrated in five pumping plants along the Colorado River Aqueduct. The Imperial Irrigation District turned power into its 600 miles of lines in October 1938. The construction of a third transmission circuit from Boulder Dam to Los Angeles had been announced in July of the same year, by the Bureau of Power and Light.[30] Then, over a connecting line which had been constructed in 1936 from San Bernardino to the Seal Beach plant, the Nevada-California Electric Corporation

---

[29] Sierras Service Bulletin, October, 1937.

[30] Electrical West, LXXXI (February, 1938), 60.

announced in May, 1938:[31]

> A special condition prevailed among the power companies of the Pacific Coast on Monday, April 18, by virtue of the possibility of interconnecting the various companies for occasional or emergency interchange of power.
>
> Last Monday, the Nevada-California Electric Corporation was interconnected to the Bureau of Power and Light system of Los Angeles through a transmission line between San Bernardino and Seal Beach, which is a normal arrangement. At this time the Bureau of Power and Light of Los Angeles was connected through a large frequency changer to the Southern California Edison Company at Long Beach. The Southern California Edison Company was connected to the San Joaquin Light and Power Company through another frequency changer at Vestal, east of Bakersfield. The San Joaquin Light and Power Company was connected to the Pacific Gas and Electric Company, which in turn was connected to the Mountain States Power Company in the west-central part of Oregon.

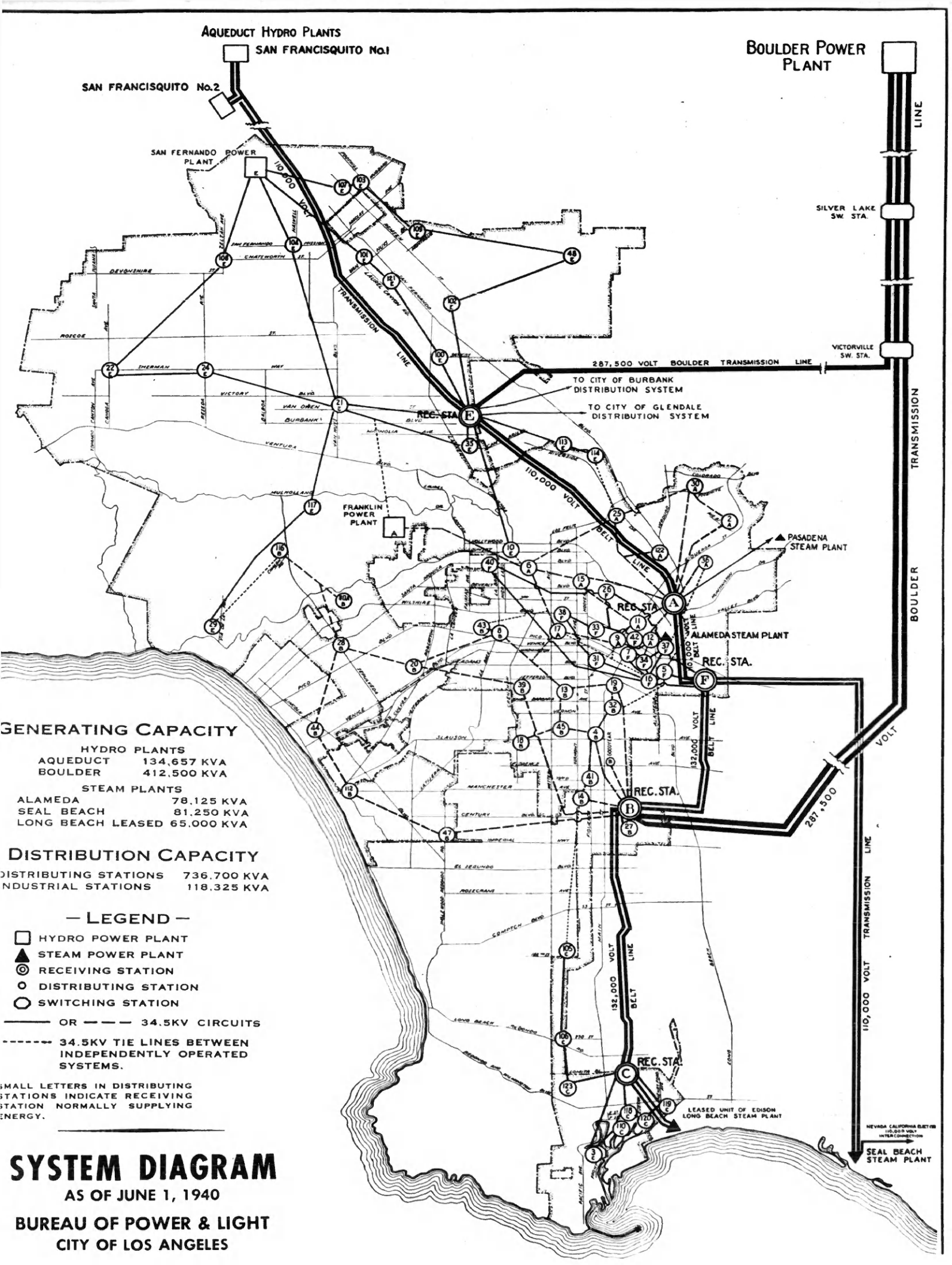
Such is the efficient super-power system of the Pacific Coast. In days of war such a system is necessary, and it is to the credit of the utilities of Southern California that a super-power system exists to benefit not only the citizens of this section but also the nation. Security has been planned. Today's necessity has already been met by hydroelectric giants.

During 1939 Boulder Dam units began serving the Southern California Edison Company. The 223-mile transmission line to Chino was energized from the first 82,500-kw. generator at Boulder on June 21st of that year. The second unit was placed on the line in September.[32] The three hydroelectric companies

---

[31] Sierras Service Bulletin, May, 1938.

[32] N. B. Hinson, "Southern California Edison Company," Electrical West, LXXXIV (February, 1940), 45.



GENERATING CAPACITY

HYDRO PLANTS

AQUEDUCT	134,657 KVA
BOULDER	412,500 KVA

STEAM PLANTS

ALAMEDA	78,125 KVA
SEAL BEACH	81,250 KVA
LONG BEACH LEASED	65,000 KVA

DISTRIBUTION CAPACITY

DISTRIBUTING STATIONS	736,700 KVA
INDUSTRIAL STATIONS	118,325 KVA

— LEGEND —

- HYDRO POWER PLANT
- STEAM POWER PLANT
- RECEIVING STATION
- DISTRIBUTING STATION
- SWITCHING STATION

——— OR — — — 34.5KV CIRCUITS

- - - - - - 34.5KV TIE LINES BETWEEN INDEPENDENTLY OPERATED SYSTEMS.

SMALL LETTERS IN DISTRIBUTING STATIONS INDICATE RECEIVING STATION NORMALLY SUPPLYING ENERGY.

SYSTEM DIAGRAM

AS OF JUNE 1, 1940

BUREAU OF POWER & LIGHT
CITY OF LOS ANGELES

serving Southern California were now served by power from the project. Much of this power was resold to municipalities or other companies. Construction of a hydroelectric plant at Parker Dam on the Colorado River was started this same year but at the close of 1941 it had not yet delivered power. "The Imperial Irrigation District expended about $2,250,000. Two hydro plants were begun on the All-American Canal: 9,600 kw. at Drop 4, and 4,800 kw. at Drop 3. Diesel sets were also added to the Brawley system."[33] The city of Los Angeles began a third line to Boulder Dam by way of its receiving station in the San Fernando Valley. It was completed in May of 1940. With the hydroelectric energy supplying the city on the increase the Bureau of Power and Light reported in August, 1940, the following segregation of power supply:[34]

Boulder hydroelectric	400,000 kw.
Aqueduct hydroelectric	100,000 kw.
Steam plants	140,000 kw.
Leased steam plant unit (So. Calif. Edison, Long Beach)	60,000 kw.

After spending approximately $675,000 for new construction during 1940, the Imperial Irrigation District completed two hydro plants on the All-American Canal; and in February, 1941, these plants began generating power. The plant at Drop Number 3 began operating February 18th, and

---

[33] M. J. Dowd, "Imperial Irrigation District," Electrical West, LXXXIV (February, 1940), 42.

[34] Ibid., LXXXV (November, 1940), 65.

Drop Number 4 plant began operating a week later.[35] As the year 1942 dawned, the whole of Southern California seemed to have reached its saturation point in respect to hydroelectric expansion. The erratic flow of its streams, the inadequacy of reservoir storage space, the high efficiency of its hydro-electric systems with their low operating costs due to the high transmission voltages, render any future hydroelectric development in this section very remote.

Southern California has grown at a terrific pace. Her industries have assumed gigantic proportions. And industries tend to locate in placed where power and good transportation are available. These attract workers who, in turn, attract other business enterprises, and thus such places tend to become densely populated centers.[36] Our cheap rates entice factories and the increased usage of electrical energy. Recently, the rates for energy from Boulder Dam have decreased; new regulations provided for a reduction from 1.63 mills per kilowatt-hour to 1.163 mills for firm energy.[37] This drop has meant cheaper energy cost for customers in the Southland.

Decades of experiments and expansion have given to this state a super-power system. With just pride may Californians

---

[35] Electrical West, LXXXVI (March, 1941), 79.

[36] Guy E. Tripp, Super-Power, An Aid to Progress, 30.

[37] Electrical West, LXXXVI (May, 1941), 178.

Drop Number 4 plant began operating a week later.[35] As the year 1942 dawned, the whole of Southern California seemed to have reached its saturation point in respect to hydroelectric expansion. The erratic flow of its streams, the inadequacy of reservoir storage space, the high efficiency of its hydroelectric systems with their low operating costs due to the high transmission voltages, render any future hydroelectric development in this section very remote.

Southern California has grown at a terrific pace. Her industries have assumed gigantic proportions. And industries tend to locate in places where power and good transportation are available. These attract workers who, in turn, attract other business enterprises, and thus such places tend to become densely populated centers.[36] Our cheap rates entice factories and the increased usage of electrical energy. Recently, the rates for energy from Boulder Dam have decreased; new regulations provided for a reduction from 1.63 mills per kilowatt-hour to 1.163 mills for firm energy.[37] This drop has meant cheaper energy cost for customers in the Southland.

Decades of experiments and expansion have given to this state a super-power system. With just pride may Californians

---

[35] Electrical West, LXXXVI (March, 1941), 79. A 25-foot head is available at Drop Number 3 and a 50-foot head at Drop Number 4.

[36] Guy E. Tripp, Super-Power, An Aid to Progress, 30.

[37] Electrical West, LXXXVI (May, 1941), 178.

claim their system to be the greatest of its character that has been produced in the world.[38] Our super-power system, linked as it is with highly efficient units, makes of Southern California a mighty factor in either offensive or defensive warfare. It is impossible to over-estimate the military value of these factors. In fact, a nation-wide super-power system, together with our national resources and topographical advantages, would render the United States well-nigh unconquerable. Thus, the electric power system that best suits the needs of peaceful progress is also one of the strongest elements of our national defense.[39]

Proper tribute to the many electrical industries in Southern California which have made its hydroelectric history possible has not been paid due to lack of space. No portion of our history stands alone; the antecedent and subsequent acts are parts of the picture. The consumption of electric energy has long been one of the norms of prosperity and civilization. In that norm of progress this section occupies a position at or near the top as nearly as such a position can be estimated. Great has been our history in this respect. Whenever and wherever hydroelectric history is mentioned, Southern California stands as the leader because of its marvelous contribution.

---

[38] W. S. Murray, Super-Power--Its Genesis and Future, 63.

[39] Tripp, Super-Power, An Aid to Progress, 60-61.

BIBLIOGRAPHY

BIBLIOGRAPHY

PRIMARY SOURCES

Baldwin, C. G., "Water Powers in Southern California," San Francisco, Journal of Electricity, VII (January, 1899).

Barker, George H., "The Cost of Hydroelectric Power," San Francisco, Journal of Electricity, XIII (February, 1903).

Baum, F. G., "Economic Value of Electric Transmission," San Francisco, Journal of Electricity, XXXII (January, 1914).

Bonner, Frank E., Report to the Federal Power Commission on the Water Powers of California. Washington, 1928.

California State Legislature, Constitution of the State of California, Article XII, Sections 22-23. Sacramento, 1938.

"The Cheapest Power Rates in the United States," Editorial, San Francisco, Journal of Electricity, XLVIII (June, 1922).

Dowd, M. J., "Imperial Irrigation District," San Francisco, Electrical West, LXXXIV (February, 1940).

Downing, P. M., "Transmission Line Problems in the West," New York, Transactions of the American Institute of Electrical Engineers, XXXIII (February, 1914).

Federal Power Commission, National Power Survey, Power Series, No. 1. Washington, 1935.

Fowler, C. E., "Water Power Plants with Long-Distance Electric Transmission in Southern California," New York, Engineering News, XLI (March, 1899).

Fowler, Frederick H., "Power Possibilities in Southern California," San Francisco, Journal of Electricity, (November, 1918).

_____, Hydroelectric Power Systems of California. Washington, 1923. Prepared in cooperation with the United States Forest Service.

Frost, W. L., "Edison System Tops High in All Records," San Francisco, Electrical West, LXXVIII (February, 1937).

Fry, Donald H., "Mt. Whitney, California, Transmission Plant," New York, Electrical World, XXXIV (October, 1899).

Galloway, J. D., "Bishop Creek, Cal., Hydroelectric Power Plant," New York, Electrical World, XLVII (June, 1906).

"Gigantic Colorado River Project," Editorial, San Francisco, Journal of Electricity, XLVI (January, 1921).

Heinly, Burt A., "Los Angeles Power Board Election on May 8," New York, Engineering News, LXXI (April, 1914).

"High Sierra Hydro-Electric Development," New York, Electrical World, LXXVI (October, 1920).

Hinson, N. B., "Southern California Edison Company," San Francisco, Electrical West, LXXXIV (February, 1940).

Hoxie, George L., Men, Money and Mergers. New York, 1932.

Hoyt, H. C., "The Big Creek Development of the Pacific Light and Power Company," New York, General Electric Review, XVII (January-December, 1914).

"Imperial Valley," New York, The Encyclopedia Americana, Vol. XIV, 1936.

Keller, Colonel Charles, The Power Situation During the War. United States War Department, Washington, 1921.

"The Lesson of the Water and Power Controversy," San Francisco, Journal of Electricity, XLIX (November, 1922).

Lee, James, Los Angeles Examiner, October 10, 1936.

Lighthipe, James A., "An 83-Mile Electric Power Transmission," New York, Cassier's Magazine, XVII (November, 1899).

Los Angeles, Bureau of Power and Light, Power for Los Angeles. Los Angeles, 1940.

_____, Boulder Canyon Project.

Los Angeles, City Clerk, "Election Statistics," prepared by Election Supervisor Torgersen.

Los Angeles, Department of Water and Power, Intake, XIII, No. 10 (October 9, 1936).

Low, George P., Editorial in San Francisco, Journal of Electricity, VIII (December, 1899).

_____, "Southern California Transmissions," San Francisco, Journal of Electricity, XII (July, 1902).

Low, George P., "The Generating, Transmission and Distributing Sy Systems of the Edison Electric Company of Los Angeles, California," San Francisco, Journal of Electricity, XIII (January, 1903), 9-13.

Maujer, A. R., "Southern California Edison System," New York, Power, XXXIV (September 5, 1911).

Murray, W. S., Super-Power--Its Genesis and Future. New York, 1925.

Newmark, Harris, Sixty Years in Southern California, 1853-1913. New York, 1926.

Pearson, B. F., "Address given at the dedication of the memorial to H. H. Sinclair," Redlands, California, 1926.

Potter, Charles F., "History of the Company," Southern Sierras Power Company, Sierras Service Bulletin, Riverside, 1935-36.

Preston, Porter J., The All American Canal, Preliminary Report of the All American Canal Board. Yuma, Arizona, 1918.

"Reclaiming Deserts by Electricity," San Francisco, Journal of Electricity, XIV (March, 1904).

Raushenbush, H. S., and Harry W. Laidler, Power Control. New York, 1928.

Reid, H. A., History of Pasadena. Pasadena, 1895.

Roosevelt, Theodore, Theodore Roosevelt, An Autobiography. New York, 1925.

Scattergood, E. F., "Letter to Editor on Distribution Problem." San Francisco, Journal of Electricity, XXX (January, 1912).

_____, "Municipal Ownership of Water Works and Supply and of Hydroelectric Power Plants," San Francisco, Journal of Electricity, XXXIII (December, 1914).

_____, "Engineering Features of the Boulder Dam-Los Angeles Lines and Some Features of the Boulder Canyon Project," New York, Electrical Engineering, April and May, 1935.

Sibley, Robert, "The Pacific Light and Power System," San Francisco, Journal of Electricity, XXVIII (February, 1912).

_____, "The Power of California," California Monthly, Berkeley, October, 1940.

Smith, R. E., "Big Creek Plant Adds 30,000 Hp. to Western Power Supply," San Francisco, Journal of Electricity, XLVII (September, 1921).

Southern California Edison Company, Outlines of Southern California Edison Company, Los Angeles, 1938.

Spalding, William A., History and Reminiscences, Los Angeles City and County. 3 vols. Los Angeles, 1931.

"The System of the United Electric, Gas, and Power Company," San Francisco, Journal of Electricity, XIII (January, 1903).

Torgersen. (See Los Angeles, City Clerk)

Tout, Otis B., The First Thirty Years, 1901-1931. San Diego, 1931.

Tripp, Guy E., Super-Power as an Aid to Progress. New York, 1924.

United States, The Statutes at Large, XXIV, Part 1. Washington, 1907.

United States, Department of Commerce, Bureau of the Census, Fourteenth Census of the United States Taken in the Year 1920, Vol. I. Washington, 1921.

United States, Department of the Interior, United States Geological Survey, "Production of Electric Power and Consumption of Fuels by Public Utility Power Plants in the United States in 1920," Washington, 1921.

SECONDARY MATERIALS

Alexander, J. A., Life of George Chaffey. Melbourne, 1928.

Cleland, Robert Glass, and Osgood Hardy, March of Industry. Los Angeles, 1929.

Drury, Aubrey, California, An Intimate Guide. New York, 1939.

Farr, Finis C., The History of Imperial County, California. Berkeley, 1918.

Faulkner, Harold Underwood, American Economic History. Fourth Edition. New York, 1938.

Goodwin, Cardinal, John Charles Fremont. Stanford University, 1930.

Hungerford, Edward, The Story of Public Utilities, New York, 1928.

Hunt, Rockwell D., and Nellie Van de Grift Sanchez, A Short History of California. New York, 1929.

Kinsey, Don J., The Romance of Water and Power. Los Angeles, 1926.

Shepard's Citations, Table of Federal Acts, "Boulder Canyon Project Act." New York, 1937.

Sutton, John Richard, Civil Government in California. New York, 1916.

Yard, Robert S., Our Federal Lands. New York, 1928.

PERIODICALS

Los Angeles, Times, January 21, 1913; October 10, 1936.

New York, Electrical World, XXVII-XXXIV, LXVII-LXXVI, 1895-1920.

Riverside, Sierras Service Bulletin. Published monthly at Riverside, by The Southern Sierras Power Company and its successors, The Nevada-California Electric Company and The California Electric Power Company. Later titles of the magazine are Nev-Cal Bulletin, and, since July 1, 1941, Cal-Electric Bulletin.

San Francisco, Electrical West, LX-LXXXVII, 1928-1942.

San Francisco, Journal of Electricity, I-XLIX, 1895-1922.