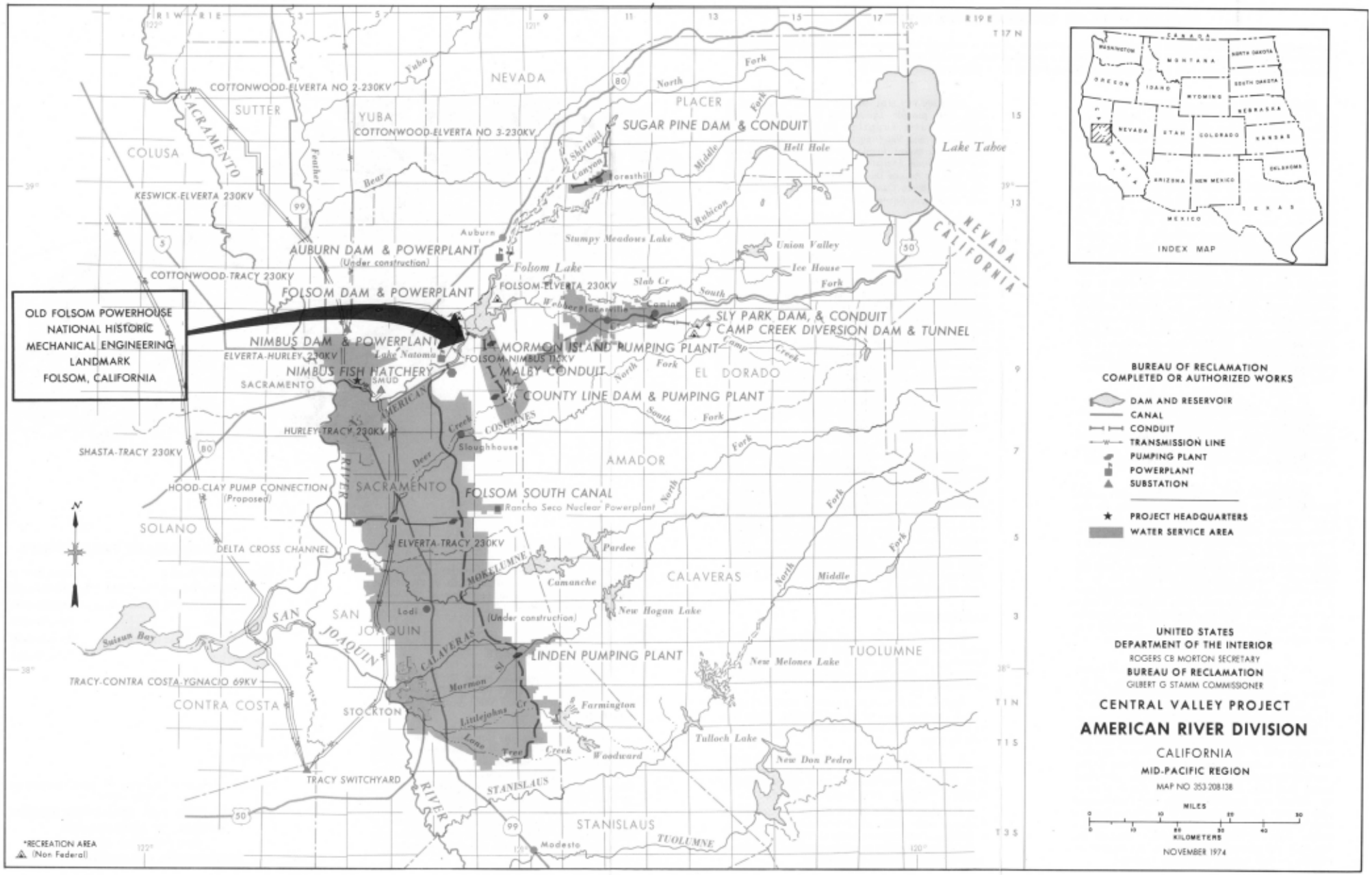
THE FOLSOM POWERHOUSE NO. 1

1895

National Historic Mechanical Engineering Landmark

The American Society
of Mechanical Engineers
September 12, 1976


OLD FOLSOM POWERHOUSE
NATIONAL HISTORIC
MECHANICAL ENGINEERING
LANDMARK
FOLSOM, CALIFORNIA
COTTONWOOD-ELVERTA NO 2-230KV
COTTONWOOD-ELVERTA NO 3-230KV
KESWICK-ELVERTA 230KV
COTTONWOOD-TRACY 230KV
AUBURN DAM & POWERPLANT
(Under construction)
FOLSOM DAM & POWERPLANT
NIMBUS DAM & POWERPLANT
ELVERTA-HURLEY 230KV
NIMBUS FISH HATCHERY
SMUD
HURLEY-TRACY 230KV
SHASTA-TRACY 230KV
HOOD-CLAY PUMP CONNECTION
(Proposed)
DELTA CROSS CHANNEL
TRACY-CONTRA COSTA-YGNACIO 69KV
TRACY SWITCHYARD
SUGAR PINE DAM & CONDUIT
FOLSOM-ELVERTA 230KV
FOLSOM-NIMBUS 115KV
MORMON ISLAND PUMPING PLANT
MALBY CONDUIT
COUNTY LINE DAM & PUMPING PLANT
SLY PARK DAM, & CONDUIT
CAMP CREEK DIVERSION DAM & TUNNEL
FOLSOM SOUTH CANAL
ELVERTA-TRACY 230KV
LINDEN PUMPING PLANT
(Under construction)
Lake Tahoe
Folsom Lake
Lake Natoma
Stumpy Meadows Lake
Union Valley
Ice House
New Hogan Lake
New Melones Lake
Tulloch Lake
New Don Pedro
Rancho Seco Nuclear Powerplant
NEVADA
PLACER
SUTTER
YUBA
COLUSA
EL DORADO
AMADOR
CALAVERAS
SOLANO
SACRAMENTO
SAN JOAQUIN
CONTRA COSTA
STANISLAUS
TUOLUMNE
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Woodward
Modesto
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(Non Federal)
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CONDUIT
TRANSMISSION LINE
PUMPING PLANT
POWERPLANT
SUBSTATION
PROJECT HEADQUARTERS
WATER SERVICE AREA
UNITED STATES
DEPARTMENT OF THE INTERIOR
ROGERS CB MORTON SECRETARY
BUREAU OF RECLAMATION
GILBERT G STAMM COMMISSIONER
CENTRAL VALLEY PROJECT
AMERICAN RIVER DIVISION
CALIFORNIA
MID-PACIFIC REGION
MAP NO 353-208.138
MILES
KILOMETERS
NOVEMBER 1974

FACTUAL DATA ON AMERICAN RIVER DIVISION

The American River Division, a part of the Central Valley Project, provides water for irrigation, municipal and industrial use, hydroelectric power, recreation, and flood control through a system of dams, canals, and powerplants. The Division includes Folsom and Sly Park Units, both in operation, and Auburn-Folsom South Unit in construction stage.

FOLSOM UNIT consists of Folsom Dam, Lake, and Powerplant, Nimbus Dam, Lake Natoma, and Nimbus Powerplant on the American River. The Folsom Unit was added to the Central Valley Project by Congressional authorization in 1949.

FOLSOM DAM AND FOLSOM LAKE. Folsom Dam, below a drainage area of 1,875 square miles, was constructed by the Corps of Engineers and upon completion was transferred to the Bureau of Reclamation for coordinated operation as an integral part of the Central Valley Project. The dam has a concrete main river section with a height of 340 feet and a crest length of 1,400 feet, flanked by long earthfill wing dams extending from the ends of the concrete section on both abutments for a total length of 10,200 feet. The dam plus the earthfill auxiliary Mormon Island Saddle Dam and eight other earthfill dikes create Folsom Lake with a storage capacity of 1,010,000 acre-feet. The dam regulates flows of the American River for irrigation, power, flood control, municipal and industrial use, fish and wildlife, recreation, and other purposes.

FOLSOM POWERPLANT, constructed and operated by the Bureau of Reclamation, is located just below Folsom Dam. Water from the dam is released through three 15-foot-diameter penstocks to three generating units. The total capacity is 198,720 kW.

NIMBUS DAM AND POWERPLANT, AND LAKE NATOMA. Nimbus Dam, 7 miles below Folsom, creates Lake Natoma to reregulate the releases for power made through Folsom Powerplant. The dam is a concrete gravity structure, 78 feet in height, with a crest length of 1,093 feet. It serves as a diversion dam for the Folsom South Canal. The power from the 13,500 kW, two-unit powerplant located at the toe of Nimbus Dam is transmitted to Folsom Switchyard over a 115-kV transmission line. Also located at Nimbus Dam is the Nimbus Fish Hatchery built to compensate for the spawning area of salmon and steelhead that was inundated by construction of Nimbus Dam.

SLY PARK UNIT was added to the Central Valley Project in 1848 along with the Folsom Unit. It includes Jenkinson Lake formed by Sly Park Dam on Sly Park Creek, a low concrete diversion dam on Camp Creek and the Sly Park-Camino Conduit. Sly Park Dam is an earthfill structure 190 feet high with a crest length of 760 feet, and an auxiliary earthfill dam 130 feet high with a crest length of 600 feet. Jenkinson Lake has a storage capacity of 41,000 acre-feet. The concrete diversion dam on Camp Creek and connecting tunnel from Camp Creek to Sly Park Creek augment the inflow into Jenkinson Lake. Sly Park-Camino Conduit with a capacity of 125 ft^3/s extends 7 miles west from Sly Park Dam to Camino to deliver supplemental water to El Dorado Irrigation District for irrigation and municipal purposes in the vicinity of Placerville and western El Dorado County.

AUBURN-FOLSOM SOUTH UNIT, authorized in 1986, will provide agricultural and municipal and industrial water supplies for Placer, El Dorado, Sacramento, and San Joaquin Counties, together with hydroelectric power, flood control, fish protection, and new recreational facilities. Principal features of the Unit will be Auburn Dam, Powerplant and Reservoir, the Folsom South Canal, and Sugar Pine and County Line Dams and Reservoirs.

AUBURN DAM presently under construction will be a 700-foot-high, concrete thin arch structure, with a crest length of 4,000 feet. The dam will create the 2.4 million acre-foot Auburn Reservoir. The reservoir will control varying flows of the North and Middle Forks of the American River. Releases from the reservoir will flow through Auburn and Folsom Powerplants and supply the Folsom South Canal, and flows to the lower American River. Auburn Powerplant will have an initial installed capacity of 300,000 kW with a potential capacity of 750,000 kW. Water from the authorized Sugar Pine Reservoir on North Shirttail Canyon Creek will be piped to the Forest Hill Divide service area for irrigation and municipal and industrial use. The authorized County Line Reservoir on Deer Creek would operate in conjunction with Folsom Lake to provide water service in the Folsom-Malby area for municipal and industrial use.

FOLSOM SOUTH CANAL is presently under construction with the first two reaches completed and operational. The canal originates at Lake Natoma, an afterbay of Folsom Dam. When completed, the canal will be approximately 89 miles long and serve industrial, municipal, and irrigation users in Sacramento and San Joaquin Counties. The canal also provides cooling water for Sacramento Municipal Utility District's Rancho Seco Nuclear Powerplant. The initial diversion capacity is 3,500 ft^3/s. Canal bottom width in the first two reaches is 34 feet with a water depth of 17.8 feet.

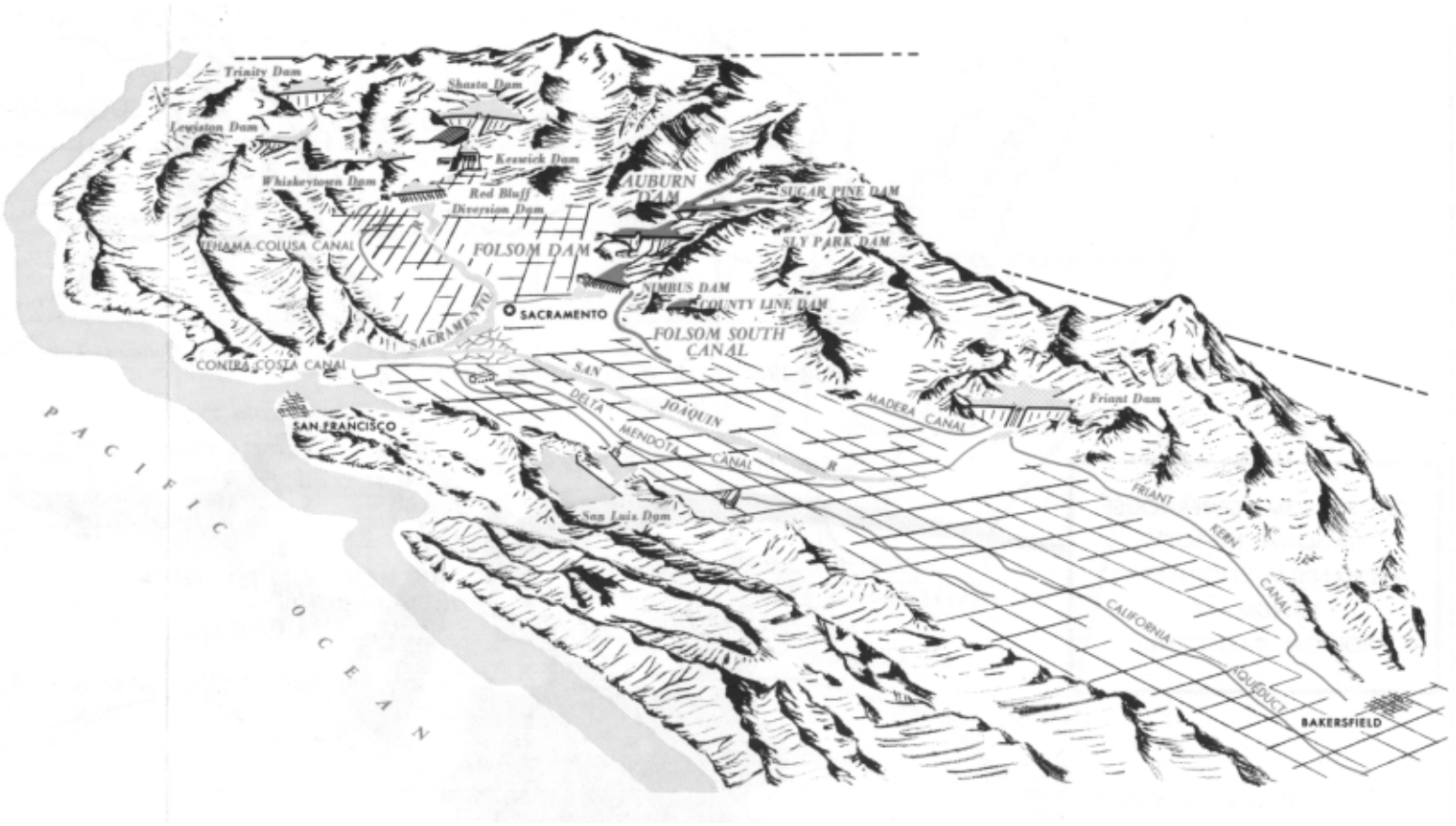
RECREATION

Folsom Lake is the most popular multiuse year-round unit in the California State Park System. Visitors to the 16,725-acre park can choose from three campgrounds. There are 60 miles of trails in the park for the hiker and horseback rider.

Anglers come to Folsom Lake to test their skill on trout, catfish, bass, perch and Kokanee. Boats can be launched from 12 ramps on Folsom Lake and 2 on Lake Natoma.

The Sly Park Recreation Area, operated by El Dorado Irrigation District in cooperation with U.S. Bureau of Reclamation, also offers camping, boating, swimming, picnicking and fishing.

The proposed recreation facilities for the Auburn Reservoir area will include camping, boating, swimming, picnicking and fishing. The Folsom South Canal right-of-way has excellent potential for hiking, bicycling and horseback riding trails.



ANNUAL RAINFALL

The normal annual precipitation ranges from 40 inches at the 3,500-feet elevation in the eastern portion of the Division to 14 inches at the southwestern edge near Stockton.

PRINCIPAL PRODUCTS

The principal products in the Sly Park Unit are pears, apples and irrigated pasture. The rest of the acreage is divided among other orchard crops and nursery plants.

Of the area presently irrigated in the Auburn-Folsom South Unit, 80 percent in Sacramento County and 40 percent in San Joaquin County is irrigated pasture and other forage crops. Grapes and deciduous orchards account for another 38 percent of the area in San Joaquin County, Rice, sugarbeets, beans, tomatoes, and truck crops share the remaining irrigated acreage in both counties. About 74 percent of the increase in irrigated acreage is expected to be in irrigated pasture, forage, and miscellaneous field crops.

CENTRAL VALLEY PROJECT MAPS

Central Valley Project	214-206-5133
Central Valley Project, North Half	214-208-4174
Central Valley Project, South Half	214-208-4175
Delta Division	214-208-4177
Shasta & Trinity River Divisions	214-208-4489
San Luis Unit	214-208-5185

Address all inquiries regarding additional information concerning this project to:

REGIONAL DIRECTOR, MID-PACIFIC REGION
BUREAU OF RECLAMATION
2800 COTTAGE WAY
SACRAMENTO, CALIFORNIA 95825

"It was 4:00 a.m. in Sacramento when a 100-gun salute shattered the quiet. People not planning on getting up early that morning never forgot it. It was when electric power arrived in Sacramento over 22 miles of line from the new Folsom Power House."

--San Francisco Chronicle, July 13, 1895--

THE HISTORIC FOLSOM POWERHOUSE NO. 1

In the late nineteenth century electricity came out of the laboratory to offer its services as a working partner in the social structure. The Historic Folsom Powerhouse No. 1 is an integral part of the story of the development of electricity for consumer use. It marked one of the first successful uses of hydroelectric power in the world. In 1895, however, many people were skeptical that electric current could be transmitted over long distances. There were few who foresaw that possibility, but the Folsom Water Power Company was one of these. This faith was reflected by the General Electric Company, which early began the manufacture of generators, and required accessories designed toward its achieving that end. Its gamble made the success of the Folsom Powerhouse possible.

And like most pioneering efforts, Folsom Powerhouse had its share of obstacles, mishaps and crises to overcome before the event which brought high-voltage alternating current over long distance transmission lines for the first time, was accomplished.

The Beginning

The story of Folsom began in 1850 with the cry of "gold!". Though it first rang out at Sutter's Mill in 1848, for years it continued to ring throughout the country, luring fortune seekers to the West. Among them was one Horatio Gates Livermore, a native of Livermore, Maine. But instead of gold, he began to see his future in the magnificent stands of sugar pine that forested the Georgetown Divide.

He was a public-spirited citizen and in 1854 was elected to the state senate. In his travels to the state capital he was impressed by the possibilities of the American River for logging purposes and for development of water power to operate saw mills and other industrial plants. He envisioned an industrial city at Folsom like the one in Lowell, Massachusetts, where water wheels had long been used to operate the New Englanders' mills and factories.

The pioneer's two sons, Horatio P. and Charles E.,joined their father in 1856, but at first they remained in San Francisco. Horatio P., then in his twenties, was employed at the western branch of Redington & Co., a wholesale drug firm he had worked for in Boston.

The elder Livermore took an interest in a company -- the Natoma Water and Mining Company -- organized to divert water from the American River to placer mining in the foot hills. By 1862 he and his sons controlled it. They also acquired for the company some 9,000 acres of land that had been a part of the Rancho de los Americanos granted to W. A. Leidesdorff by a Mexican governor. Much of it contained deep gold-bearing gravel deposits. In the foothills the elder Livermore planted 500 acres in orchards and vineyards to demonstrate his faith in the agricultural future of the region. They eventually built a fruit-drying plant and winery at Folsom. The additional land also gave them water rights to the American River which enabled them to float logs down the stream.

However, if Livermore's dream of an industrial city was to be realized, a dam would have to be built above Folsom at Stony Bar Gorge to be used as a holding area for logs, and to provide water for factories and storage for farm irrigation.

The first step was the construction of a two-mile railroad from Folsom to the damsite and laying the foundation of the dam itself. This was done by the Natoma Water & Mining Company at a cost of $119,000. The company soon realized they would have to find a way to minimize remaining construction costs, so the Livermore's made a deal with the State Prison Board in 1868 to obtain convict labor in exchange for land. Easier said than done. The convict labor couldn't be supplied until the prison was built, and getting the prison built was an arduous task to say the least.

The Prison

In 1858 the California legislature decided to establish a branch prison to supplement the original penitentiary at San Quentin, and a choice of location was restricted to the granite-quarrying district at Rocklin or the granite district near Folsom. Year after year no selection of a site was made by the prison directors, and the matter was allowed to drag.

The deal proposed by the Livermore's in 1868 managed to awake the legislature from its Rip Van Winkle sleep of 10 years to push through a resolution requiring that a choice between Rocklin and Folsom be made by the prison directors before July of that year. The Livermores' dam was only partly built and there was an immense amount of work ahead to complete it, so the ambitious Livermore's met the prison directors and offered big inducements to get the prison at Folsom. Obviously, their proposition was accepted, but not without a few snarls. By 1880 the convict labor had not yet been supplied, and the Livermore's had been waiting for 12 years -- even after agreeing to give the prison an additional 134 acres of land in 1874, making a total area of approximately 484 acres.

In 1881 the stockholders of the Natoma Water and Mining Company formed the Folsom Water Power Company. One of the first things they did under their new name was to demand the prison labor due, and they even insisted on a more generous agreement -- double payment in convict labor. The State sued and lost in an attempt to force the company to abide by its old offer, so work on the dam ceased.

Negotiations dragged along until 1888, when Governor Stoneman came into

office. Then the Company made a new proposition to the State on May 5: The State would furnish the convict labor necessary to complete the dam and build the canal as far as the mud sink at Robber's Ravine -- a distance of about 6,000 feet below the dam, and in consideration of that labor the company would then give the State additional waterpower produced by a fall in the prison yard of 7.33 feet, instead of the originally designated 5-foot fall; would give the State the right to use the company's railroad line from Folsom up to the prison, provided the State kept the road in repair; would permit the taking or pumping from the canal of all water desired on the prison property for irrigation and domestic purposes; would permit the taking of gravel from the adjacent river bed, which was all owned by the Company; would permit ingress and egress over the company's lands on the river side of the prison, and the passage over the company's land of a prison sewer to flow into the river.

These rights, aside from the water power, were considered by the prison warden to be worth more than the value of the convict labor desired. He reported to the governor that the water power alone would produce 800 hp which, at the existing price of fuel, would otherwise cost $64,000 a year to produce and would mean to the State the equivalent of a million-dollar power investment. The new proposition was readily accepted by the State and the prison agreed to provide 60,000 man-days of convict labor annually for 5 years. Work began on the dam and canal July 1, 1888. H. T. Knight was the company's engineer in charge of construction. Later he became superintendent of the power plant, a position in which he was succeeded by his son.

The work was at last completed in January 1893. Unfortunately, Horatio Gates Livermore never lived to see it to the finish; he died in 1879.

Horatio P. Livermore

Horatio P. was a man of inexhaustible energy and persistent enthusiasm. During the 1880's he gradually took over the many business operations started by his father, Horatio Gates, and others. In 1888 he launched a lumber enterprise similar to the timbering plan designed years before by his father; but the log drives were difficult in the boulder-strewn river, and the expensive experiment was abandoned. But Horatio P. had another idea which paid off.

In the late 1880's he began to see that by the time the dam was finished water power as a direct motive force for the wheels of industry would be superseded by electric power. He believed that the water of the American River could turn generators for electricity in Sacramento, 22 miles downstream, in spite of the fact that up to that time electric power had never been transmitted more than five miles.

His belief was not without foundation. He had kept abreast of electrical developments, had read of the early application of electric power in California mines, had studied reports of transmission experiments in Germany and Italy. It was obvious (to him) that the water power developed at Folsom Dam should be used for production of electric power and that the market for that power was in Sacramento. But finding knowledgeable people who would agree that electricity could be transmitted such a distance ecnomically was not easy.

Livermore learned of the advances made by Frank J. Sprague in the development of a direct-current motor for operation of electric railways. This gave him an idea. Folsom power could be used to operate the Sacramento street railways. Confident that a way could be found, he went ahead. To arm himself with a negotiating weapon, he personally obtained a franchise to build an electric railway system in Sacramento, regardless of the fact that the Central Electric Railway Company had been operating its cars by battery for the past year. Livermore actually built a stretch of double track on H Street. Next he wrote to Sprague, who had installed electric streetcars in Richmond, Virginia, stating his problem in detail. Sprague offered to design a workable system.

Convinced then, that he was on the right course, Livermore incorporated the Sacramento Electric Power and Light Company, November 5, 1892, to build the powerhouse and construct the long-distance power line and a distribution station in the capital city. He also assigned to the new corporation the street railway franchise.

He renewed his correspondence with Eastern manufacturers who had been lukewarm to his proposal that they plan a transmission system from Folsom to Sacramento and a method for conversion of alternating current to direct for delivery to the streetcars. Finally, the Westinghouse Company sent Engineer L. B. Stillwell to California to investigate. Armed with all the data, he returned to Pittsburgh and eventually his company submitted a plan, explaining meanwhile that the whole problem was theoretical and their suggested solution experimental.

When General Electric heard of the Westinghouse activities, it also developed a new interest in the Folsom project and sent Engineer F. O. Blackwell and Professor Louis Bell to study the problem. G. E., on the basis of its experts' reports, followed its competitor with an offer to build the Folsom system.

Livermore had won his point. He had in hand two sets of plans and specifications for construction of the Folsom plant and transmission system. The new Sacramento Electric Power and Light Company was to build and operate the system, taking its water on lease from the Folsom Water Power Company. There remained the financing of the project, no small task in the depression years of the early nineties.

Albert Gallatin

Livermore was to find the needed funds through one of those fortuitous circumstances which so frequently came to the rescue of utility enterprises of the past century. Dr. Thomas Addison was Western representative of the recently formed General Electric Company. His offices in San Francisco adjoined those of the hardware firm of Huntington, Hopkins & Co., which in 1886 had moved from its original home in Sacramento. Albert Gallatin, president and general manager, had risen to the high command after Collis P. Huntington and Mark Hopkins had turned over operation of their hardware business to their employees when building the Central Pacific Railroad required all their attention.

Gallatin knew the Sacramento picture. He had been an officer of the board of trade there when that body had tried to hasten the building of Folsom prison. During the years since, he had been an officer of the Citizens Gas Company and had helped organize the Capital Gas Company. When he learned from his friend, Dr. Addison, about the financial needs of the Folsom Water Power Company, he decided to act.

Gallatin started negotiations into which were called J. Dalzell Brown, Vice President of the California Safe Deposit & Trust Company; George H. Roe, President of the Edison Electric Light & Power Company; and Charles R. Lloyd, a promoter and stockholder in the Edison Company. Gallatin, Addison, and Lloyd went East for conferences with Charles A. Coffin, President of General Electric; and with officers of the Electrical Securities Company of Boston, an underwriting firm with which G. E. had close financial relations.

An agreement was reached after many conferences and much maneuvering. The Electrical Securities Company agreed to underwrite a block of the Livermore company's bonds. General Electric was to build and install equipment for the electric system -- quite an investment for one company while in the midst of a national depression.

The contract was signed early in 1894 and work on the powerhouse began October 10 of that year. While work was being rushed to completion, Livermore and Gallatin had concluded an agreement with the Central Electric Railway Company for purchase of the street railways. The new Sacramento Electric Power & Light Company had its first large power customer. Merger of the Central Electric Railway properties into the Livermore project was concluded in 1894, upon payment of $250,000 in cash and $265,000 in bonds of the Power and Light Company.

Meanwhile, the transmission line to the new substation at Sixth and H Streets in Sacramento was completed and equipped to deliver power to the newly acquired street railway system. And shortly after, the Powerhouse itself was completed. After rigid testing Folsom Powerhouse was ready for operation. The impossible had been accomplished.

A Word About Charles E.

Though Horatio P. plays a major role in the story of the Folsom Powerhouse, a principal partner in Horatio's ventures was his brother, Charles E. Livermore. Though both brothers had interests in the wholesale drug business and quicksilver mining, among others, their main concern was the development of water power at Folsom. Charles was at the head of the company when the plant began operations.

Horatio P. was the financial manager of their enterprises and was married. Charles never married but always made his home with his brother. He was an ardent lover of athletic sports, established the first rowing club on California waters, and was one of the fourteen original incorporators of the Olympic Club of San Francisco. While not educated in engineering or art, he developed natural talents for these subjects and was an original member of the San Francisco Art Association.

"Description gets lost in admiration of the witching delights of the night's brilliant display."

--History of Sacramento Valley--

THE LIGHTS GO ON

On July 13, 1895 at 4:00 a.m., the General Electric Company representative at Folsom threw the switch and lights flashed in Sacramento. Here's how the History of Sacramento Valley describes events leading up to this historic moment:

"Meanwhile, on the banks of China Slough, across from the powerhouse at Sixth and H, a detachment from Battery B was waiting for the signal to fire their two field pieces to announce the arrival. It had spent one chilly night in fruitless anticipation of the great event and, warned in advance, came prepared for a second night's vigil with blankets and a tent. Their bivouac was named 'Camp Shock' in honor of the Superintendent of the Central Electric Company, and possibly with an ulterior idea of the current they were soon to salute. At four o'clock in the morning on July 13, 1895, the signal from the powerhouse called the men to their positions, and the sound of a hundred gun salute awakened Sacramento to a new day and a 'new era'."

The real public inaugural of the Folsom plant was held September 9 -- in conjunction with the State Fair "celebrating the forty-fifth anniversary of the admission of California into the sisterhood of states."

The Sacramento Bee had suggested a giant celebration and the idea was taken up by the community, which planned the event for September when power would be adequate and crowds would be in the city for the State Fair.

Said the Bee:

> With the advent of the power of lightening [sic] sent to us by the Giant of the Waters, comes possibilities not dreamed of a few years ago. A grand future is opened before us of which our quick witted and intelligent citizens will not be slow to avail themselves. From the condition of a small town, the end of a railroad division, dependent on the Southern Pacific Company and the Legislature for its existence, Sacramento will become a manufacturing center to which the rest of the state must pay tribute. . . This is the birth for us of Power, of Growth, of Greatness. It is right that we should rejoice and celebrate it in this Grand Electric Carnival, September 9, 1895.

Preparing for the Carnival of Lights

Accommodations for visitors expected to come to Sacramento to celebrate Admission Day and view the Electric Carnival were a source of much concern. On September 2, the Bee estimated that there would be at least 10,000 people from San Francisco alone, since the Southern Pacific had already sold 7,000 tickets for the excursion and had ordered 3,000 more printed. A final estimate of the number of visitors made after the event and based on tickets sold, concluded that no less than 30,000 persons had come to Sacramento on Sunday and Monday, September 8 and 9. Special rates had been arranged from all valley towns, based on the regular one-way fare plus one-third for a round trip. The usual fare to San Francisco was $2.50 each way, making the special holiday excursion $3.33 for the round trip. The railroad had cooperated further by offering free transportation to musical organizations.

The problem of housing visitors was solved by a committee of Native Sons of the Golden West, who compiled a list of rooms available in private homes and hotels, reserving them at a uniform price of "one dollar per person, two dollars for a double bed." It was suggested that tents could be put up in the Plaza with cots and new bedding for fifty cents a night, but the response of Sacramento citizens in offering rooms made this unnecessary. It was estimated that two thousand rooms were filled on Sunday night. "Good meals were offered for fifteen cents and higher, and coffee and pie, or coffee and cake were ten cents in the coffee houses."

People were urged to decorate using the carnival colors of cherry red, apple green and golden yellow, so that every foot of J and K Streets and all cross streets will be "one grand poem of color". Said the Grand Marshal's Proclamation: "As the day has been dedicated to the Native Sons, so will the night be reserved for the Electric Carnival."

The Carnival

And on that night Sacramento looked like this:

"Hundreds and hundreds of electric lamps were blazing brilliantly and both sides of J and K Streets were lined with paper lanterns for three miles. Business houses on both sides of the street were literally covered with bunting arranged in all manner of shapes -- stars, crosses, fans, diamonds and festoons.

"Elaborate arches had been erected over the streets and electric set pieces -- designs made up in colored lights -- had been placed in special locations.

"Every tree in Capitol Park bore fruit like the ones in the gardens in the fairy tales, and there were apples of green and gold and crimson enough to tempt a sybarite. . . Throughout the evening the electric current behaved beautifully. It never wavered in its duties an instant.

"The State Capitol Building shone with electric lights outlining the facade and the ribs of the dome, where a cluster of arc lights, twelve in all, of two thousand candlepower each, made a dazzling display that could be seen for fifty

miles away. Across the west entrance to the building were the names of Morse, Franklin and Edison, outlined in incandescent bulbs.

"Three names that should be honored above all at an Electric Carnival in an American City -- Franklin, who brought the electricity from the clouds; Morse, who gave it a tongue; and Edison, who furnished it with eyes to see and ears to hear."

That night left an indelible memory in the minds of those who witnessed the parade, composed of civil and military units, sixty brass bands and twelve electric floats from the shops of the Southern Pacific. Each float was mounted on the frame or bed of an electric street car, drawing power from an overhead trolley to propel itself and light the exhibit. The Carnival Committee's float featured an American flag, eight by ten feet in size and composed entirely of colored lights. Along the border were two smaller Bear flags, a log fort, and a grizzly bear. The twelve floats from the Southern Pacific shops brought rounds of applause as they passed, and were called the "crowning glory of the parade."

Newspapers throughout the state were enthusiastic in their praise of the electric light carnival. The San Francisco Examiner declared:

> . . . description gets lost in admiration of the witching delights of the night's brilliant display. The temptation is to pile superlatives as high as the electric maypole or the dome of the capitol.

Following the Carnival display, the Sacramento Bee said:

> In Sacramento has been first practically solved the grave problem of the long transmission of electric current for power and light purposes. Not only is this the longest power transmissisn line but also the largest electric power plant in the world, in the sense of power actually developed.

One might think with all the fanfare, glory and praise over the Powerhouse the new venture would find the Livermores and their associates sitting on easy street. But of course, life is never that simple.

"After all, this was the longest distance that electric power, strong ensugh for commercial uses, had been sent."

--Sacramento Bee
July 12, 1895--

THE POWER PLANT

When it was placed in service July 13, 1895, it represented a momentous advance in the science of generating and transmitting electricity. From Folsom came power that was transmitted long distance (22 miles) to Sacramento. Up to that time power had never been transmitted more than five miles. This achievement proved that low-cost hydro-electric energy could be carried to distant population centers.

Some Elementary Facts

Electric current is generated by spinning coils of copper wire -- an armature -- between magnets. The more coils there are and the faster they spin, the more current is produced by the generator. A turbine, or water-driven engine, is one of several power sources that can be used to impart the spinning motion. A pipe line, or penstock, was built along the bottom of the original dam to lead the water to the turbines in the Folsom Powerhouse, which were set at the lowest possible elevation to wring the maximum energy possible from the falling water.

The units at Folsom, called reaction turbines, have a series of blades mounted on the turning element, or runner. Water is admitted through a series of fixed guide vanes and strikes all the blades simultaneously. When the water enters through the guide vanes, the direction of its flow is at at right angles to the shaft of the turbine; the water is deflected and leaves the runner nearby parallel to the shaft. The great force exerted on the blades as the water flow changes direction turns the shaft and drives the connected generator shaft.

When the Folsom plant was in operation, the water was directed to the turbines by inlet pipes each eight feet in diameter. The four pairs of McCormick turbines were run under a head (water pressure) of 55 feet of water and at a speed of 300 revolutions per minute. Waterflow through the turbines was regulated to match the fluctuating demand for electric energy, by opening or closing valves at the turbine-inlet.

The turbines are directly connected to the six-inch armature shafts of Folsom's generators. In 1895 these units were reported to be the largest three-phase dynamos ever constructed. Each stands 8 feet, 8 1/2 inches and weighs 57,877 pounds. Their combined capacity is 3,000 kilowatts, Brought to California by ship around Cape Horn, the vintage generators are still in place at the power-house. The control switchboard at Folsom, faced with Tennessee marble, is another part of the original equipment that is still intact.

its Newcastle and Auburn plants in Placer County. The Placer County company, strong financially and operating at low cost, not only offered still lower rates but contracted with the gas company to supply it with its surplus power, thus strengthening the opposition to the struggling Livermore enterprise.

The fight for existence went on. Piling trouble on trouble, the years 1897 and 1898 were "dry" years and the need for more electric power resources became acute. Livermore had always figured that the American River could forever be relied upon for an unusually large flow during the dry season. Its numerous branches all have their rise in the Sierra Nevada mountains within a few miles of Lake Tahoe (see enclosed map). The heavy snowfall on the ridges there and the late melting of this snow would furnish abundant water late in the season when the effect of the rains had long since waned in other districts. The theory was all right, but the practice did not work out just that way.

From 1896 to 1898 the waterflow in the river fell to unexpected lows during the dry season; with the acute need for more electric power resources, it was necessary to construct an additional powerhouse in 1897 to produce more electricity. This was done by taking advantage of the 26-foot drop between the original power-house and the river. The turbine in this powerhouse was set low to get as much drop as possible, but the generator was set high to keep it safe from floods. A unique rope drive using 2,200 feet of continuous-strand hemp with a system of wheels and drums was created to connect them.

Additional financial help came in 1899 when the Yuba Electric Power Company operating the Colgate plant on the middle fork of the Yuba River completed a 61-mile transmission line to bring more power to Sacramento under a contract with the Livermore company. Strengthened by the new source of power, the Sacramento Electric, Gas and Railway Company renewed its fight for leadership. The old Capital Gas Company, whose electric plant had become virtually obsolete and which had lost much of its gas lighting business to the electric competitor, was taken over by the Livermores in 1899. The South Yuba Water Company's electric subsidiary did not attempt to expand its business. The pendulum had swung in favor of Gallatin and the Livermore's.

So, by the turn of the century the financial picture had improved for the company and business was expanding, but the struggle had been long and grueling for the Livermore's and their associates.

"The Folsom Powerhouse was later described as the greatest operative electrical plant on the American continent."

--Sacramento Bee
July 13, 1895--

THE FIRST DAYS OF BUSINESS

The new company started operations with Albert Gallatin as President, J. W. Hall, Manager, T. A. W. Shock, Superintendent, and C. W. Hutton, who had been Electrical Engineer for the Capital Gas Company, Assistant Superintendent. By October 1895, the plant's four generators were producing 3,000 kilowatts to be used by the electric street railway and by industrial and commercial establishments.

Even though Folsom was extolled as "the greatest operative electrical plant on the American continent" there were troubles. At first the powerhouse crews were never sure of the needs of Sacramento. They often shut down at the regular time only to get frantic calls to "start her up again" as there were trolleys stranded all over town.

Competition was another problem. The first solicitations for business uncovered powerful opposition from the Capital Gas Company, which for years had enjoyed a monopoly in both the gas and electric fields.

The old company lowered its rates and was accused of using its political influence with the city government to prevent the newcomer from obtaining needed franchises. There were charges, also, that the same influences were blocking the sale of power to the Southern Pacific, a large potential customer.

At times the Livermore company was hard pressed to meet its financial obligations. Sale of its bonds became increasingly difficult, and cash contributions from the stockholders were necessary.

Reorganization and consolidation of the related Livermore companies was accomplished April 4, 1896 in an effort to improve the financial picture. Thus, the Sacramento Electric, Gas and Railway Company was incorporated, bringing under one ownership the Sacramento Electric Power and Light Company, Folsom Water Power Company and the old Natoma Water & Mining Company. A bond issue of $1, 500, 000 was authorized. The consolidation, however, failed to cure financial ills of the enterprise. Competition from the well-established Capitol Gas Company and the newly formed Central California Electric Company was still heavy. And General Electric began to assert an increasing influence upon the financial operations of the company to protect its large holdings of bonds taken in payment for the plant equipment.

To make matters even worse, a new competitor appeared January 1, 1897 -- the Central California Electric Company, wholly owned by the powerful South Yuba Water Company, which began delivering electric power to Sacramento from

The massive General Electric transformers are each capable of conducting from 800 to 11,000 volts of electricity, and the forebays and canal system that brought the water from the dam still exist today as they did in 1895.

Some Stastistics

As described in the National Register of Historic Places Inventory-Nomination Form:

"The main generating plant consists of a concrete lined intake canal and forebay, intake gates, penstocks, turbines, generators and transformers. The structure is two story in height, and measures 94 feet north to south and stands approximately 45 feet high. The first floor ceiling is 25 feet above ground. Substructure components are built of granite. Corrugated iron covers the pitched roof.

"Walls are 24 inches to 30 inches thick on the first floor and 20 inches on the second. Inlet pipes, eight feet in diameter, directed water to four pairs of McCormick turbines. Directly connected to the turbines were the 6 inch armature shafts of the generators. These units, the largest 3 phase dynamos constructed to that date, provided an output of 3,000 kilowats.

"In its day a concrete lined tailrace carried water from the main generator turbines to a second low head generator housed in a corrugated iron building at a lower level. This building still exists. It is a single story (tall) frame structure measuring 69 feet east to west by 34 feet, built in 1897. It is made up of 2" by 8", 8" by 12" and 12" by 12" timbers and covered on the exterior by corrugated iron. The pitched roof is also covered with corrugated iron. The foundation is concrete. It houses the fifth generator for the hydroelectric plant. This subsidiary power plant used a 26 foot fall of water from the main powerhouse to the river to produce 750 kilowatts of electricity. To achieve maximum efficiency the turbine assembly was set low to take advantage of the 26' drop in the tailrace. The generator was set high above the turbine safe from flood damage. Large ropes connected the turbine pulley with the generator. An ingenious system of pulleys and counterweights controlled rope slack and stretch. The timbers on this building, which is maintained and used as a museum, are in sound condition.

"Another building alternately used as a powerhouse office and a tool house is located a short distance north of the main structure. This structure is a single story frame measuring 54' 61" north to south by 12' 6", and has a 7' by 18' lean-to porch on the west wall. The interior walls are open stud, the exterior walls are covered with wood shingles. The pitched roof is also covered with wood shingles. This building was constructed in 4 by 6 stringers supported by brick, close to the ground."

The Journal of Electricity, No. 3, San Francisco, 1896, described the Folsom Powerhouse as follows:

"The hydraulic machinery was made and furnished by the S. Morgan Smith Company of York, Pa. and consists of four pairs of 30-inch McCormick Turbines,

having a capacity of 1260 hp each. The wheels run under a head of fifty-five feet at 300 revolutions per minute and are directly connected to the armature shafts of the generators by couplings. The inlet pipes are 8' in diameter, and made of five-eights inch steel. Double draft tubes are provided for each set of wheels.

"The wheels are made of phosphor-bronze and the work throughout combines the latest and most improved practice in hydraulics. The hydraulic equipment weighs upward of 100,000 pounds, and the plant, as a whole, is believed to be the most massive and powerful in the world, with the single exception of that at Niagara.

"The entire city of Sacramento is now lighted under contract with the municipality by arc lights from dynamos driven by Folsom power and a very large business in private lighting is already being done. New demands for power are arising daily. Among the establishments now using the power are found flour mills, railroad shops, machine shops, box factories, hotels, etc.

"Sacramento is an important railroad center and there the Southern Pacific and Central Pacific Railroads have built their largest shops, employing upwards of 2,000 men. These companies have entered into contracts with the Electric Company for lighting, and also for power to a large extent."

The Dam

When the dam was constructed water-power under high head was not yet a practical engineering development. By using a very gradual fall of about one foot in every 1000 feet of canal the promoters found they could deliver an enormous flow of water to Folsom at a point about 80 feet above the river bed. From the forebay at the lower end of the canal they could easily secure a sudden fall of 55 feet, and that would give them what was then considered considerable power.

The Forebay

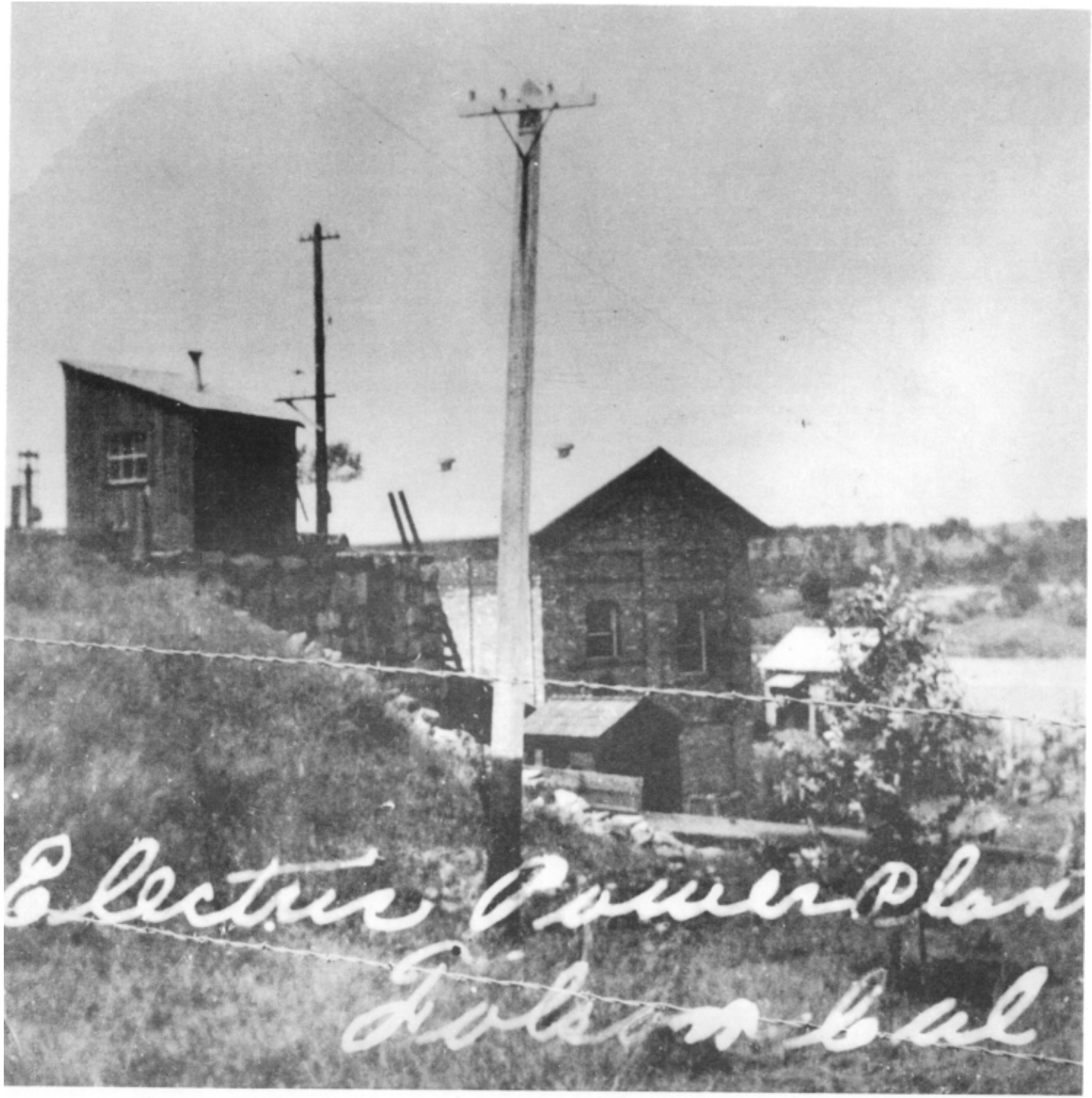
Because of the extensive hydraulic mining for gold which occurred, large quantities of sand and gravel were carried by the American River and the canal leading to the powerhouse. Thus a rather large forebay (to create low velocities) was built. It was also divided into two lengthwise portions so that de-silting could be accomplished without complete shutdown of the powerhouse.

Post Script

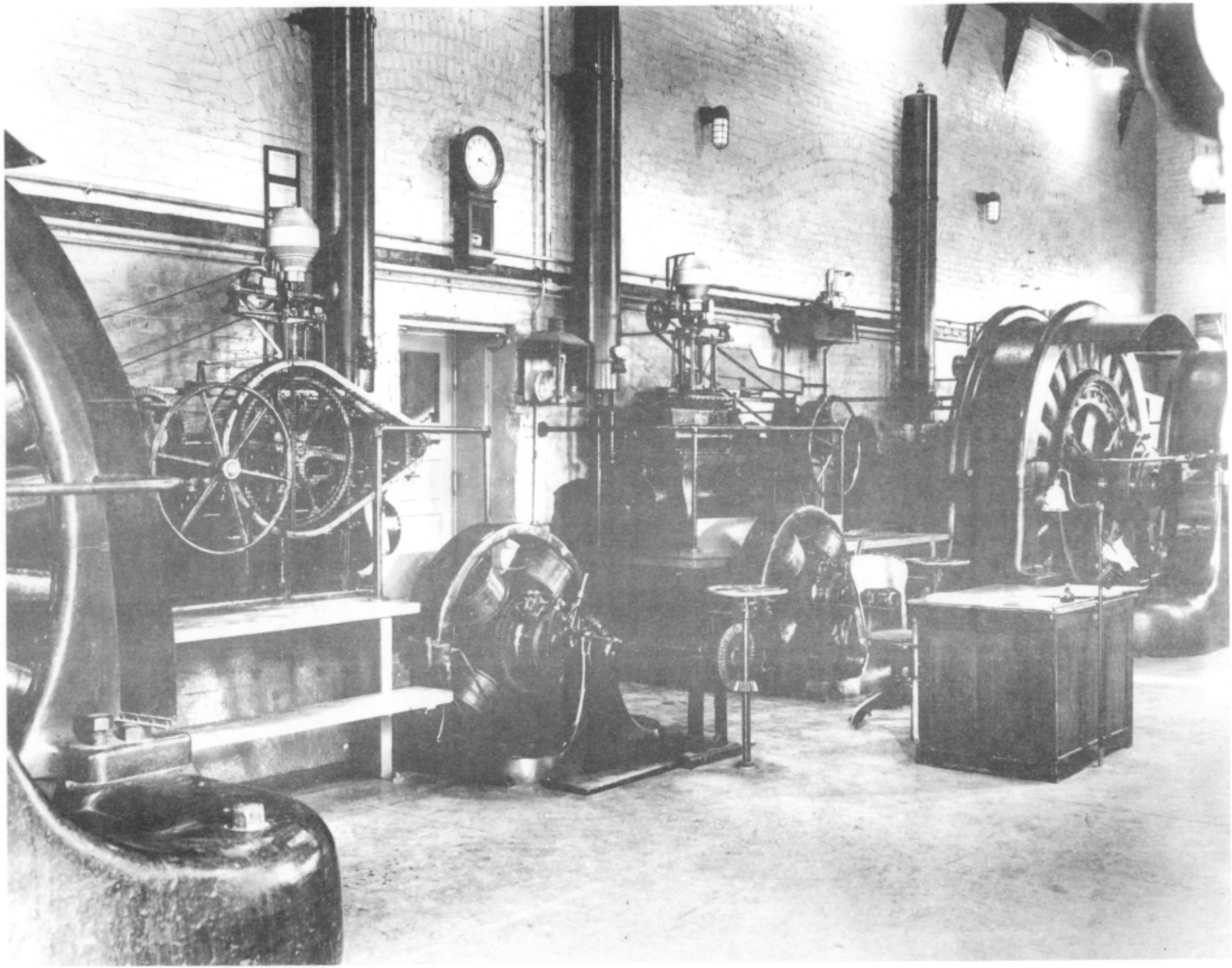
Engineers came from distant cities to inspect the installation. The editor of the Journal of Electricity referred to Sacramento as "the first American city to demonstrate the practicability of long distance transmission at high voltage."

In 1905 the Pacific Gas and Electric Company acquired the Folsom Powerhouse No. 1 and in 1952, after 57 years of continuous service it was shut down due to the construction of the new Folsom Dam. In 1958, on August 22, a ceremony was held donating Folsom Powerhouses No. 1 and No. 2 to the State of California.

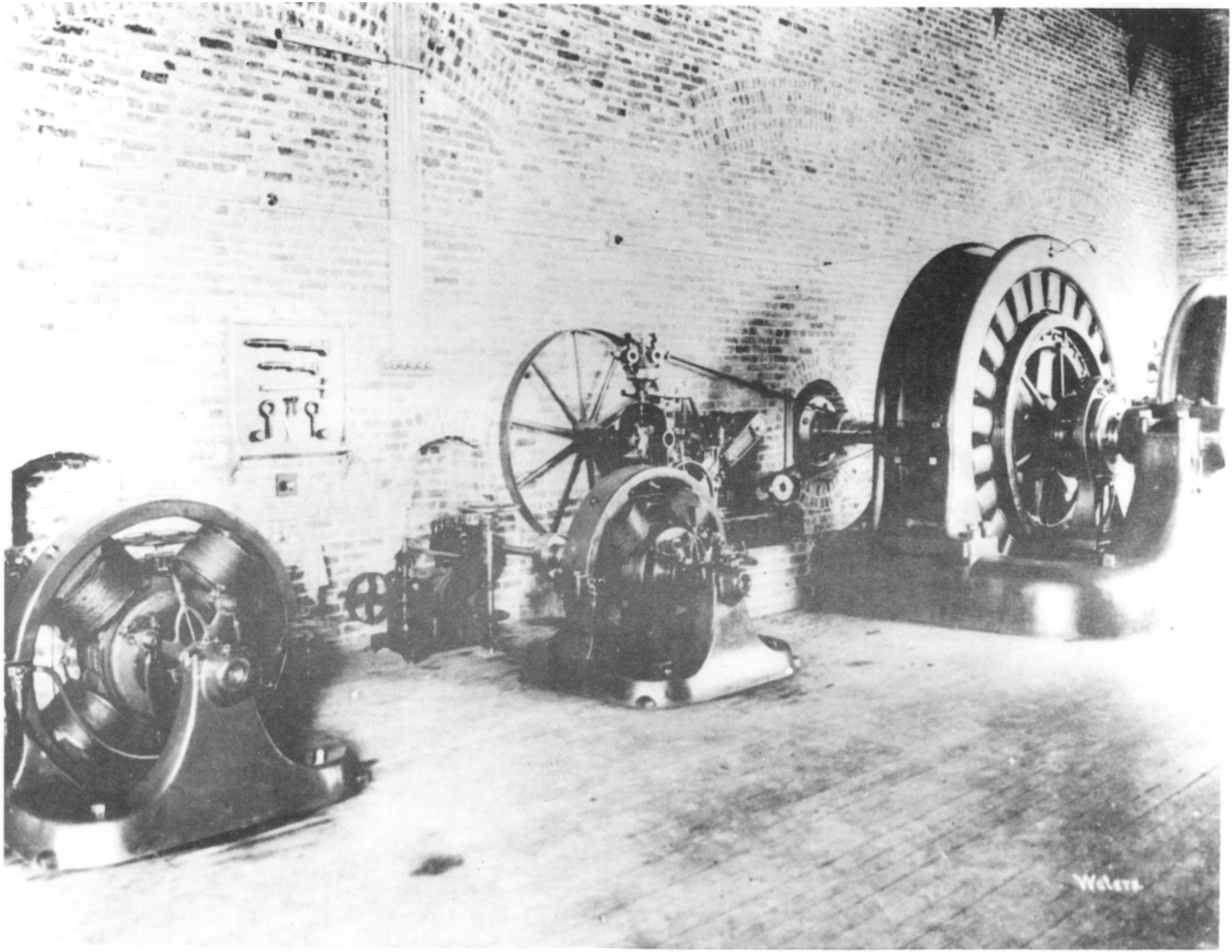
Today, the Powerhouse canal is dry and its building no longer hums with activity. Its record-setting days are over. However, for those who cannot recall ever having long been without electric lights and power, it symbolizes a major



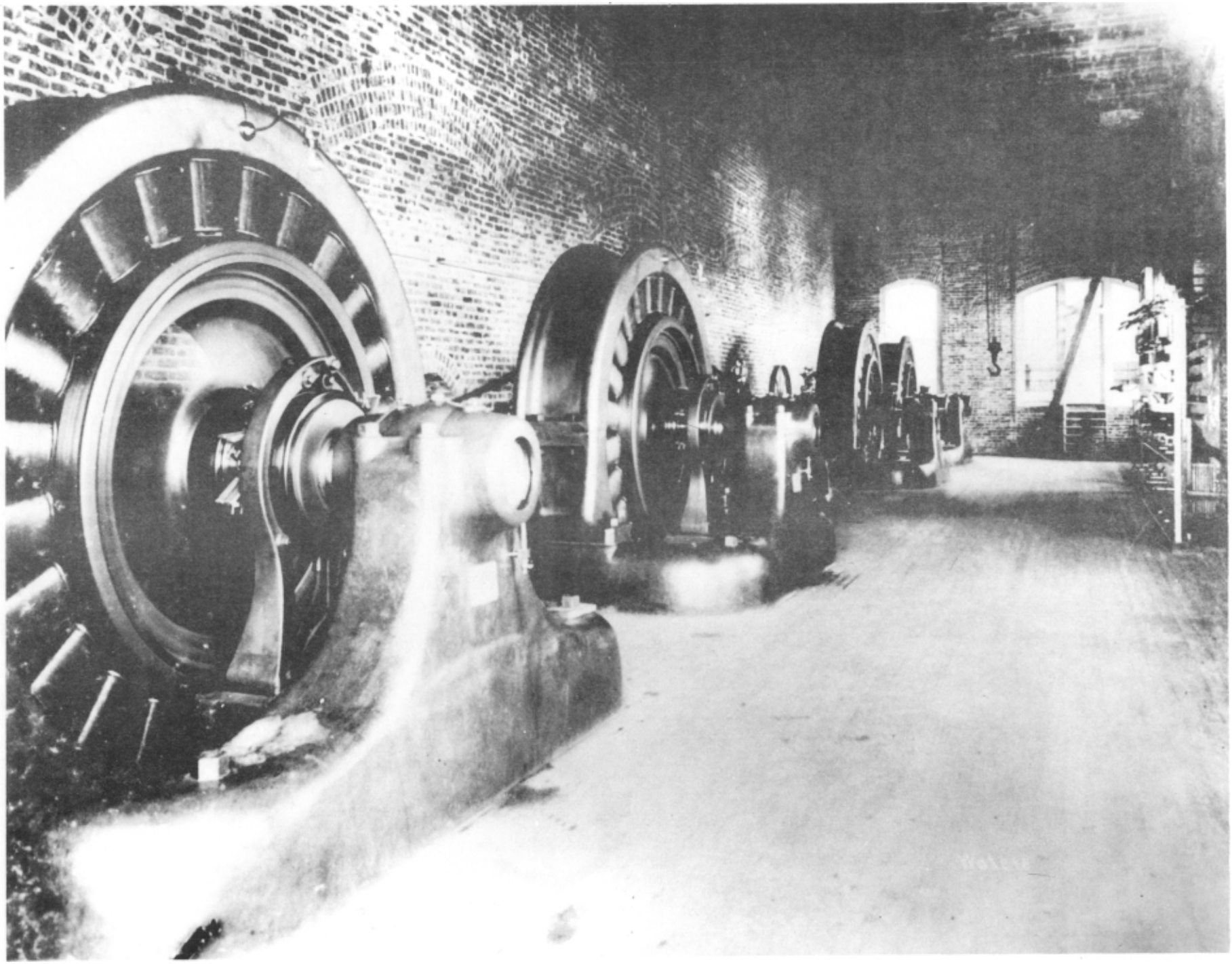
From 1895 to 1952, the Folsom Powerhouse No. 1 pioneered and provided electric service to thousands.



In full operation the Folsom machinery could generate 3,000 kw at 800-11,000 volts.



This view shows the original water wheel governors made by Faesch Pickard and the exciters. The exciters are 500 volt DC generators that created an electromagnetic field for the large AC dynamo.



Sectional view of the Folsom Powerhouse generators. In 1895 they were reported to be the largest three-phase dynamos ever built.

A view of the original 12 air-blast transformers, later replaced by Westinghouse transformers.

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