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Public Utilities
FORTNIGHTLY

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River of Gold

No, not the Yukon! While we remember the Klondike district of 1896 as fabulous, by 1910 its rich hand diggings had been pretty well dug —and since then the mining operations largely have been hydraulic or dredging. Up to 1920, or twenty-four years after the Bonanza Creek discovery, the entire Klondike district had yielded about $170 million worth of yellow gold. Quite a tidy sum—but read on!

By HENRY L. GRAY*

THIS is an article about the Columbia river—the "Oregon" of Carver and Bryant. The first federal electric power plant on the Columbia began operations in 1938, and during the next twenty-four years, or to 1962, the Columbia and its tributaries produced *more than $2 billion* worth of white gold —which we know as electric power. The riches of the Columbia are not found in gravel bars and nugget patches, but in its volume of water; its relatively precipitous descent, or fall; and the rugged topography of the country through which it flows; all of which make possible the economic location of power plants and the production of electric power. In these respects, it is truly a River of Gold!

Some folks think that "Oregon" was the Northwest Indian's name for the Columbia—which it was not. The early explorers did not tell us the Indian name, which was "Chiawana." The name "Oregon" was first mentioned by Captain Jonathan Carver in his book of travels published in 1778, describing his stay with the Great Lakes Indians some years previous. The name "Oregon" presumably has no derivation, yet its origin

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seems clear. The French explorers had been around for fifty years or more, and had heard of the tempestuous river to the west, which they called "O-ra-geux," which means "stormy" or "thundering." The French told the Great Lakes Indians about it, and they told Carver—hence his "Oregon." Bryant had seen Carver's book and was impressed with the name, which he effectively used in his immortal thanatopsis. In the meanwhile, in 1792, Captain Gray, the discoverer, named the river "Columbia" after his ship.

THE Columbia is not such a large river, being only about one-half as long as the Mississippi—and it carries less water—but it has a relatively precipitous descent, or fall, which occurs principally at rapids and other unconformities at strategic topographical points suitable as sites for hydroelectric power plants.

The Columbia probably is the greatest power stream in the world, with the possible exception of Africa. Its drainage area contains about 40 per cent of the hydraulic power potential of the United States and it is said to be less than one-half developed. It is an international stream rising in a small British Columbia lake of the same name. Its total length is 1,210 miles, of which 745 miles, or 65 per cent, are south of the Canadian border and within the United States. The total fall is 2,650 feet, of which 1,290 feet, or 49 per cent, are within the United States. Between the border and the furthest downstream power plant at Bonneville, a distance of 600 miles, there is a fall of 1,282 feet, of which 1,193 feet already have been utilized by federal and local public power plants. There are no privately owned power plants on the main river.

THE first hydroelectric generating station on the Columbia was built at Priest Rapids in 1906 by a group of Seattle men promoting an irrigation project near the town of Hanford—now the location of our extensive plutonium production industries. This generating station was a small affair used in producing power for pumping irrigation water from the river, and was operated by water diverted by means of a small wing dam. The two generating units were rated at 1,000 kilowatts each. This plant successfully operated for fifty-two years until 1958, when it was removed to permit the construction of the present large hydro development at Priest Rapids. It was in excellent condition at the time it was removed.

First Dam on River

IN 1929, one of our local private electric utilities started the construction of a dam across the Columbia at Rock Island Rapids, just below Wenatchee, utilizing a small island in the river as part of the dam. This was the first dam across the Columbia. By present-day standards, the generating station was modest, containing four 15,000-kilowatt units, with provision for a number of additional units. This plant started up in 1933 and operated until 1956, when the entire layout was purchased by one of our 22 local public utility districts, which greatly enlarged the plant and now operates it.

The federal power development of the Columbia started as an irrigation scheme. In ages past, central Washington was subjected to volcanic eruptions and basaltic lava flows which left it a barren waste; and when the Cascade Mountains rose and cut off the moisture-laden winds from

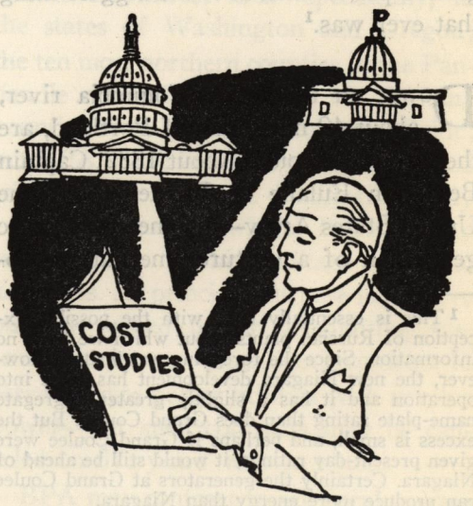
the Pacific, the desolation was complete. Due to the subsequent weathering of rocks, along with dust deposits from later volcanic activity, and the macerations of the terrain by glaciers, this area eventually was covered to a considerable extent with a soil commonly known as volcanic ash, which, when watered, is productive. However, owing to a lack of atmosphere moisture, for untold years central Washington remained a desert. In modern times, as the country was settled, irrigation became a hope. This hope was not a new thing. As far back as 1853, Territorial Governor Stevens called attention to the possibilities of the Grand Coulee country; and just after the beginning of this century, several successful irrigation districts were formed in the south-central area, using the waters of the Yakima river; but nothing was done to bring water to the main-central part.

WHILE there was constant agitation for such irrigation, the start of the Rock Island dam in 1929 really was the trigger, and there was a lot of constructive thinking about a big irrigation project for central Washington. There were differences of opinions; and while some favored irrigating that area with water diverted from the Pend Oreille river in Idaho and brought in by canals, the general idea was to try to get water from the Columbia in some manner. It could be seen that during the glacial period a tremendous dam of ice had been thrown across the Columbia, which was diverted from its course and cut a new channel through the lava plateau, forming the gigantic chasm we know as Grand Coulee. Incidentally, "coulee" is a French word meaning "an outflow of lava." It was thought by many that the Ice Cap could be imitated and that a dam could be constructed across the river and some of its water diverted or pumped into a storage reservoir in Grand Coulee.

The agitation continued, and in 1927 Congress issued House Document 308 instructing the Army Corps of Engineers to investigate the entire Columbia basin situation. The Engineers reported in 1931 and recommended 11 different projects on the main river, of which eight already have been built, while two are under construction by local public utility districts. As to Grand Coulee, the Corps of Engineers recommended a joint power and irrigation project, with a high dam for power production purposes; a part of which power was to be used for pumping irrigation water into a large storage reservoir to be located in the 27-mile-long Grand Coulee. It was estimated that the power sales eventually would pay a large part of the cost of the irrigation system.

Congressional Authorization

IT will be recalled that many things happened about this time. We had a severe



depression and Congress voted $3.3 billion for emergency relief work to be done under the Public Works Administration. In 1932, Washington's United States Senator Clarence C. Dill armed himself with the recommendations of the Bureau of Reclamation and of the Corps of Engineers and marched on President Franklin D. Roosevelt, and asked for $400 million for Grand Coulee, even though that project had not been authorized by Congress. President Roosevelt was a bit staggered, but agreed to divert $63 million to Grand Coulee in order to get men at work, with the understanding that the Bureau of Reclamation should spend the money. So on July 16, 1933, at an appropriate celebration, Senator Dill turned the first shovel of dirt at Grand Coulee.

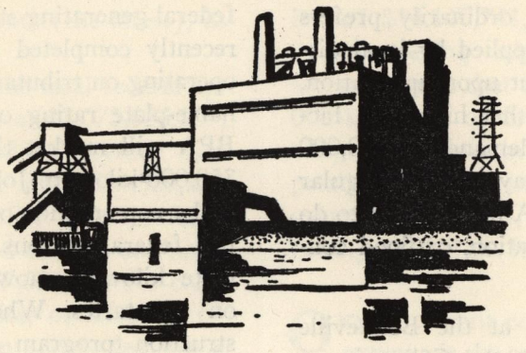
That was the beginning of our Columbia river power system—a big beginning, for the Grand Coulee dam is the largest structure ever made by man. It backs water 151 miles to the Canadian border. The generating station is the largest in the world. The pumping units for irrigation water each has a capacity of 628,320 gallons per minute. It is the biggest thing that ever was.[1]

Down on the lower Columbia river, about 40 miles east of Portland, are the Cascade Rapids. About 1832, Captain Benjamin Eulalie de Bonneville of the United States Army—a somewhat erratic gentleman of a venturesome nature, obtained a two years' leave of absence to go on an exploring trip to the Oregon country. After being given up for lost, he suddenly reappeared on the job, and later became Commandant at the United States Army post at Vancouver, Washington. He met up with Washington Irving, who took quite a shine to him and wrote him up in great style—but some historians view his exploits with jaundiced eyes. But he will eternally be famed for one small exploit which perpetuated his name—he surveyed the country around Vancouver; and as a result, Cascade Rapids became Bonneville Rapids, which was a natural power site.

So, while Senator Dill was engaged in getting money for Grand Coulee, Oregon's Senator Charles F. McNary quietly arranged for some $44 million for a power development at Bonneville Rapids. As the result, the Bonneville project was started in October, 1933, although not authorized until several years later.

As the Bonneville plant is smaller and much less elaborate than Grand Coulee, it was apparent that it would be the first in operation; so on August 20, 1937, Congress adopted HR 7642, called the Bonneville Project Act, which authorized the appointment of an Administrator for the Bonneville project and such other federal projects as might be built in the Columbia river basin, such Administrator to serve under the Secretary of Interior, who would be a member of a board to consist of the Secretaries of War, Interior, and Agriculture, and the Federal Power Commission. All federal projects within the Columbia basin were to be constructed and operated by the Army Engineers or the Bureau of Reclamation; and the newly created federal agency, which we know as the Bonneville Power Administration, or BPA, was to market the power generated at such federal plants.

[1] This is essentially true, with the possible exception of Russian plants about which we have no information. Since the foregoing was written, however, the new Niagara development has come into operation and it has a slightly greater aggregate name-plate rating than does Grand Coulee. But the excess is small, and perhaps if Grand Coulee were given present-day ratings, it would still be ahead of Niagara. Certainly the generators at Grand Coulee can produce more energy than Niagara.



The Administrator was authorized and directed to construct transmission lines, substations, and other facilities necessary to sell such power at wholesale and to enter into 20-year contracts covering such sales; and to at all times give preference to public bodies, such as states, public utility (power) districts, counties, and municipalities—although the act provided that excess power available might be sold to private utilities or industries—and that all rate schedules should be approved by the Federal Power Commission, and subject to periodic changes; but all contract rates should run for five years without change. All receipts from sales were to go to the United States Treasury, excepting a certain limited continuing fund for emergencies.[2]

[2] Thus, if BPA needs more money, it must get it from Interior. The federal plants are operated by their builders, U. S. Engineers or Reclamation—but BPA load dispatcher controls the outputs. All costs of operating and maintaining the federal stations for which BPA markets are charged up against BPA—so, to all intents and purposes, BPA really runs the federal plants.

Facets of BPA Operation

The reader may be interested in learning something about this large federal power development, which started as a relief project and became an empire. It will be recalled that BPA is the marketing agency for the output of the local federal power stations, which actually are operated by their builders—the Army Engineers or the Bureau of Reclamation; but as BPA is charged with the operating costs, for brevity these will be considered as BPA generating stations. At present, BPA transmits and markets power in the Pacific Northwest area—specifically, in the states of Washington and Oregon; the ten most northern counties in the Panhandle of Idaho; and the 11 Montana counties west of the continental divide; but BPA is not limited by geography and with proper economic justification may extend its lines anywhere. It delivers to substations on its high-voltage transmission lines. Its principal purpose is to serve publicly owned power distributing systems, but it may (and does) contract to serve private power utilities with surplus power—but such contracts may be canceled on five years' written notice.

BPA may contract to sell surplus pow-

er to industries, but ordinarily prefers that such loads be supplied by local distributing concerns; but upon application, electrochemical and other high load factor industries with demands of 10,000 kilowatts or more may get the regular BPA tariff rates. BPA has nothing to do with irrigation, navigation, or flood control.

OPERATIONS began at the Bonneville power station on the Columbia on June 6, 1938. At that time the combined generating facilities within the present BPA marketing area had an aggregate name-plate rating of 1,509,892 kilowatts. At the end of 1961 the comparative rating was 11,976,640 kilowatts—an increase of 693.21 per cent in twenty-three years, or a straight average annual increase in the twenty-three years of 30.13 per cent.

Of the 1961 total of 11,976,640 kilowatts, 6,459,250 kilowatts were in BPA generating stations (including Ice Harbor), those stations being machined to take care of large maximum demands, and with permissible overloading they can carry an aggregate peak of 7,093,300 kilowatts; but in periods of critical stream flow, their firm power capacity is limited to 4,047,000 kilowatts. The 1961 maximum demand, which included a considerable high, high-water peak, was in excess of 4 million kilowatts. While BPA still has firm power for sale, that may not last for long.

BPA has 8,224 circuit miles of high-voltage transmission lines, on which are 208 substations. BPA markets the outputs of the five federal power plants now operating on the main river, with 5,585,400 name-plate kilowatts; and nine federal generating stations (including the recently completed Ice Harbor station) operating on tributaries, with a combined name-plate rating of 873,850 kilowatts. BPA will market the output of the 1,350,000-kilowatt John Day station now under construction on the main river, and five federal stations with 570,000 name-plate kilowatts now under construction on tributaries. When the present construction program is completed, BPA will market for a Columbia river power system of 20 hydroelectric plants with a combined rating of 8,379,250 kilowatts. At present, the storage plants are Grand Coulee, with 5,232,000 acre-feet of usable storage; and Hungry Horse, with 3,161,000 acre-feet. BPA eventually will market for three federal plants on tributaries which have been authorized but not yet under construction. One of those is Libby, on the Kootenai—the construction of which will depend upon the ratification of the United States-Canada Treaty. Libby will have 5,010,000 acre-feet of usable storage.[3]

Federal Investment

NATURALLY one wonders how this unusual federal power venture has turned out. One can get an idea from the

[3] The five federal plants on the Columbia, running downstream, are Grand Coulee, Chief Joseph, McNary, The Dalles, and Bonneville. The John Day plant, now under construction, is between McNary and The Dalles. This will make six federal plants on the main river. In addition, the Chelan County Public Utility District owns Rock Island and Rocky Reach, both on the main river. Grant County Public Utility District owns and operates the Priest Rapids plant on the main river, and is now constructing the Wanapum plant some miles up river from Priest Rapids. So at present there are eight plants operating directly on the main river—five federal and three PUD; and when the plants under construction are completed, there will be ten plants on the main river—six federal and four PUD plants.

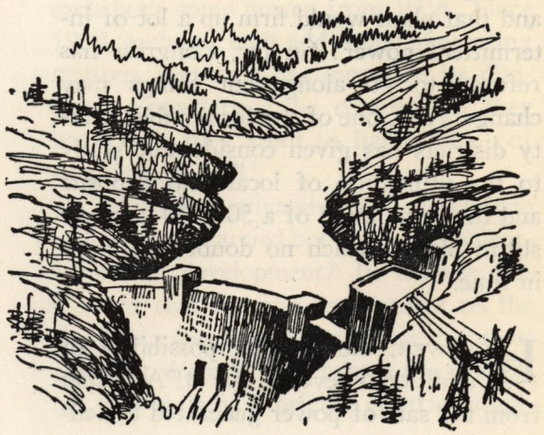
BPA 1961 annual report (the latest), as follows:

To June 30, 1961, the total federal appropriation for BPA was $3,073,623,107, of which $261,440,455 represented construction in progress; and $634,559,531 went for facilities other than power—such as irrigation, flood control, and navigation—leaving $2,177,623,121 for commercial power facilities, of which $16,727,635 had not been spent—leaving a net appropriation for the BPA transmission system and the 13 stations in full operation on June 30, 1961, of $2,160,895,486. Out of that all plant costs and operating expenses have been paid—the latter having been $199,732,629 for operation, maintenance, and administration, and $283,560,108 for interest paid on money advanced (generally 2½ per cent) a total of $483,292,737, which when deducted from the net appropriation of $2,160,895,486 leaves $1,677,602,749 as the net original cost to June 30, 1961, of all power facilities in full operation on that date.

SINCE the beginning of operations in 1938 to the date given above, the total gross electric revenue has been $787,941,456. Deducting the offsetting expenses shown above, or $483,292,737, leaves $304,648,719 as representing depreciation and net revenue as paid into the federal Treasury. As the scheduled repayment was $266,854,917, BPA considers that on June 30, 1961, it was ahead of its repayment schedule by $37,793,802.

However, with increased costs, the margin is rapidly declining and BPA is running behind in its provision for repayments, or amortization. For the fiscal year 1961 there was an amortization deficit of $14,140,741, hence BPA is diligently seeking additional revenue. It seems ironical that BPA has about 500,000 kilowatts of firm power which it is obligated to hold in order to provide for possible increases in load growths of its contract customers, which power could readily be sold on long term contracts

ONE important possibility of increased revenue is the sale of so-called "high-water" power which is represented by water going over the dams during the late spring and summer months. There is sufficient machine capacity in the plants to utilize this high water, and if some way could be found to sell the resulting electric power, it would bring in a large revenue; but as it is seasonal and intermittent, only a small part of it can be sold locally. The best chance of its sale is in California. With our hydro plants, the peak occurs in winter; but the California peak occurs in summer, due to irrigation pumping; and about 70 per cent of the energy produced in California comes from thermal plants with relatively high operating costs, which could be shut down whenever low-cost high-water pow-



er was available from BPA. An intertie has been proposed and the matter is being studied; and very likely a connection will be built, which will give both states a great advantage due to diversity and permit BPA to sell high-water power for from $10 to $20 million annually. This will require some legislation to insure that the Pacific Northwest shall have first call upon power generated by stations in the Columbia river basin. In 1961, the average sale price of BPA energy was 2.35 mills per kilowatt-hour.

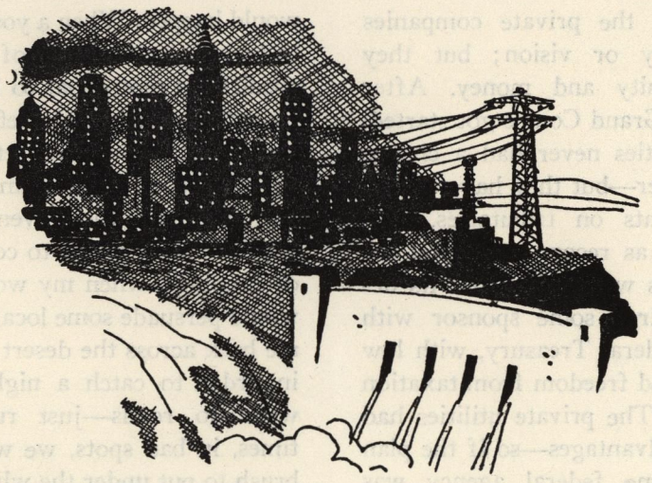
THERE is another possibility. During short peak periods, the hydro stations will take most of the high water; but if steam-generated power was available to fill this gap, or to "firm up" the high-water power, much of it could be sold as firm power. BPA now supplies power to the Hanford engineering works, which manufactures plutonium for the Atomic Energy Commission. A new reactor is being installed there at a cost of about $120 million; and by spending about $25 million more for accessories, this reactor will produce enough steam to supply a 750,000-kilowatt generating plant, to cost about $95 million—and that plant would firm up a lot of intermittent power! So far, Congress has refused to go along—but things may change. Also, one of our local public utility districts has given considerable study to the utilization of local coal deposits and the installation of a 500,000-kilowatt steam plant—which no doubt will come in time.

HOWEVER, the greatest possibility of additional revenue for BPA is that from the sale of power generated at federal stations with Columbia river water to be stored in British Columbia. That is provided for in the treaty between the United States and Canada, which has been signed, but not yet ratified by Canada because of objections by British Columbia, which must provide the construction money.

By the terms of the treaty, Canada will construct three storage reservoirs on the Upper Columbia and the Kootenai at a cost to Canada of about $345 million, which reservoirs will have usable storage of about 15.5 million acre-feet. This storage is to be operated in the best interests of both countries, so that the BPA generating stations in the United States can produce about 2.6 million kilowatts from the increased stream flow at a total increased plant and transmission cost to BPA of about $410 million. Of this total 2.6 million kilowatts of power (called "downstream benefits"), British Columbia will get one-half—so that the BPA system will have about 1.3 million kilowatts more to sell.

Aspects of the Treaty

THERE are several other important features in the treaty, such as permission from Canada to back the waters of the Kootenai ("Kootenay" in Canada) river some 43 miles in Canadian territory, thus permitting the construction of the Libby power station, with its large storage. Also the payment to Canada by the United States of $64 million for flood-control benefits; but, in the main, the important detail is the increased power available. British Columbia would like to have its share—but with its present plans, it has very little use for it. The treaty provides that this power may be sold in



the United States, and Mr. Bennett, Premier of British Columbia, already has looked in that direction; but the Dominion government is opposed to the export of such power and its sale in the United States on long-term contracts. So we are stymied for the time being—but by the time you read this, things may have changed.[4]

WHAT of the future? There are six federal hydro plants now under construction—with three more authorized. There are two very large public utility district hydro plants which have just come in, and two more under construction. There are two city-owned plants under construction, as well as several privately owned plants. There are six other federal and nonfederal plants seeking authorizations or licenses, and eight more in prospect. Trouble is, that most of them are relatively high cost. If this region's firm power load doubles in the next ten years, as is freely predicted, we may have to go to steam.

WHAT about the privately owned electric power utilities in the BPA area—how have they come out? Well, there are five such companies in this area. Each has a number of generating stations, but each buys some power from BPA. Since 1938, each has built additional generating stations, and each has increased its dividend. Considering the competition they have had, they seem to have come out surprisingly well!

Could the privately owned electric utilities have carried out this unprecedented power development? In answer, remember that the first hydro plant on the Columbia was built by private enterprise; and that the first dam across the Columbia was built by a private electric utility.

[4] BPA eventually will market for the planned federally owned Columbia river power system of 20 power plants, which will consist of plants upon the main river and tributaries. At present, there are five federal plants operating on the main river. Of the six federal plants now under construction, only one—John Day—is on the main river. All of the three authorized federal plants not now under construction will be on tributaries. Of the 14 plants seeking authorizations or licenses, only one—the Douglas County Public Utility District plant at Wells—will be on the Columbia. It is doubtful if it will be built.

I do not think the private companies lacked capability or vision; but they lacked opportunity and money. After Bonneville and Grand Coulee got started, the private utilities never had a chance on the main river—but they have built a number of plants on tributaries. The power program as recommended by the Army Engineers was so big that its development required some sponsor with access to the federal Treasury, with low interest rates, and freedom from taxation and regulation. The private utilities had none of those advantages—so if the plan was to go, some federal agency was necessary—which was and is BPA. That is how it looks to me. Has it been a good thing for the Pacific Northwest? Well, just let anybody turn loose $3 billion and a lot of cheap power in an area, and see what happens!

I HAVE seen what happened—but I lacked the clairvoyance to see what would happen. When a young man, I used to travel up this River of Gold in an unpredictable motorboat to look over leaky irrigation canals and inefficient pumping equipment owned by settlers trying to get started on what seemed to be doubtful ventures, without even a dream of the mighty power plants to come. Sometimes of evenings, when my work was done, I would persuade some local friend to drive me back across the desert to the railroad, in order to catch a night train. There were no roads—just ruts—and many times, in bad spots, we would pull sagebrush to put under the wheels to get traction. In the fading light the desolate country would seem to take on a despairing sort of beauty; but there were no mirages to picture the vast atomic energy works which some day would be there!

"Ye who listen with credulity to the whispers of fancy"—well, go ahead and whisper—for now I will believe anything!

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