Eileen Dam a great spot

When you take a hike in Boundary County you are apt to find a combination of three things - history, scenery and stunning wildlife.

And, if you are lucky and you know where to look, you can find all three.

Visitors looking to find a little history mixed with their enjoyment of wildlife and scenic vistas would do well to take a hike up to the Eileen Dam, just off the Moyie River. The dam was originally built to provide power for the Buckhorn mine.

However, it didn't quite work according to plans. The dam was supposed to block the Moyie River deep in the canyon, but the engineer overestimated the strength of the rock wall on the east side of the canyon and underestimated the forces of nature.

The powerful currents of the Moyie River tore out the rock wall and water flowed around the dam. That particular spot on the river is known by kayakers and whitewater rafters as the "Hole in the Wall."

Anyone who has rafter the river will tell you what an exciting experience it is to maneuver around the dam - since if you don't hit the eddies around the structure, you could run into it!

After the dam wall blew out repairs were not attempted.

Located north of the current Bonners Ferry city hydroelectric power plant, the dam can be found off the Moyie River Road by taking at left off of Highway 2 at Moyie Springs. After driving five miles, crossing the Spokane International Railroad tracks, the Moyie River Road tracks, the Moyie River Road takes a sharp left. Follow until you see a parking lot on the right.

Don't attempt this road unless you have a sturdy pickup and beware in spring, the road can get particularly muddy.

Old Timer's Photo...

photo and story by

THE EILEEN DAM remains but the power plant is gone.

In February, 1923, directors of the Cynide Gold Mining Comny completed plans to construct a dam and power plant on the loyie river below Eileen box canyon on four acres of land rchased from John Beck. Bonners Ferry business men were rincipal investors but stock was also sold in Montana, Washingn and elsewhere. Over 150 stockholders made investments.

Construction began that year and by June the power plant was ilf finished. Some reports rated the hydro plant at 500 H. P. hile others held the plant would produce 675 H. P. Six transormers were purchased for the system on June 28, 1924. Ten iles of transmission line were to carry electricity from the ileen plant to the company's Scout and Buckhorn mines high in e mountains of Deer creek drainage in Boundary county.

Construction work continued through 1924. The dam was ted as one of the largest in north Idaho. There were 85 men mployed in construction. The concrete dam was 150 feet long at e top, 58 feet high, 12 feet wide at the base and two feet wide at the top. Estimated overall cost was $75,000.

In January, 1925, the Cynide Gold Mining Company commenced operations and by March of that year had sent samples of gold bearing ore to assayers.

On May 7, 1925, the company held its annual meeting and authorized a maximum amount of capital stock from three to five million dollars.

On Tuesday evening of May 19, 1925, high waters of the Moyie river ripped out a section of shale-like natural rock formation on which rested the dam's east end abutment causing a ten foot raise in the Moyie river below the dam. Four miles downstream was the City of Bonners Ferry power plant where the river's raise took out the iron railing on the rock retaining wall below Moyie Falls.

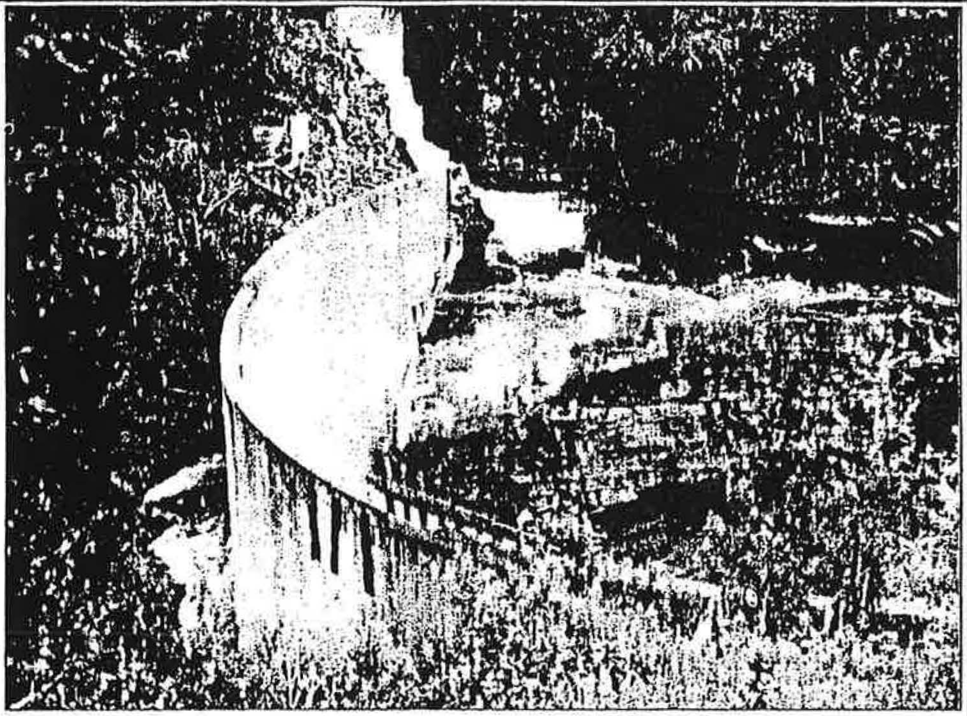
Efforts made later by the Cynide Gold Mining Company to sell stock to finance repairs were never successful.

Eventually, all inventory in the power house was removed, the power house dismantled and left-over iron sold for salvage.

Little or no damage was done to the Eileen dam which remains a reminder of hopes and aspirations of the Cynide Gold Mining Company.

OLD TIMER'S PHOTO

Eileen Dam



The Eileen dam on the Moyie River was a part of the Cynide Gold Mining Company. A powerhouse with generator was to provide electricity for mining operations on Deer Creek. A number of Bonners Ferry people had invested in the company's venture and were stockholders.

The Eileen dam was an arch dam with a timber lined spillway around the left abutment which rested on shale rock. Its first year of operation was in 1925 when the forebay was full of spring runoff waters which soon cut away the spillway and then flaked off the shale rock to leave the abutment hanging in mid-air. Some witnesses reported the shale rock flew off like shingles from a roof in a heavy wind storm.

The Eileen dam is 53 feet high with a six foot concrete base in the river bottom. Top of this base is 64 inches thick and narrows down to 24 inches at the crest of the dam. The dam has a 65 foot radius and crest length is 154 feet. The concrete mix included 20 pound railroad rails on 2-foot centers, both horizontally and vertically.

Arch dams, such as the Eileen dam, do not fail and in this case it was shale rock on which rested an abutment that caused the damage.

In current years, the Eileen dam site has been a popular location for river recreation

LUMBER YARD IS DESTROYED 1921

About 3 o'clock Saturday morning the lumber yard of Schmidt Bros., on Deer creek, near Eileen, was almost completely destroyed by fire. Only one small pile of lumber was unburned and it was so badly scorched that it was rendered unsalable. The lumber was white pine and Mr. Schmidt said the loss would run form $100,000 to $150,000.

The fire was discovered by Henry Henige, who recently purchased and moved upon a tract of timber adjoining the yard. When first found the fire had made little headway and Mr. Henige, who was alone, at once started to notify the Smith Bros. at their mill which is located about a mile and a half up the creek from the yard. With the exception of Mr. Schmidt and one helper the camp was practically vacated and by the time the three men had returned to the yard the fire had gained considerable headway and very little could be done to stop it. By using the flume water, the one stack of lumber was saved and the end of the flume was kept from burning.

Feeling suspicious that the fire had been set, the men made an investigation and soon found tracks of a man where he had come and gone from the lumber yard and in the direction of Eileen. The tracks were then followed some distance and were headed in the direction of Moyie Springs.

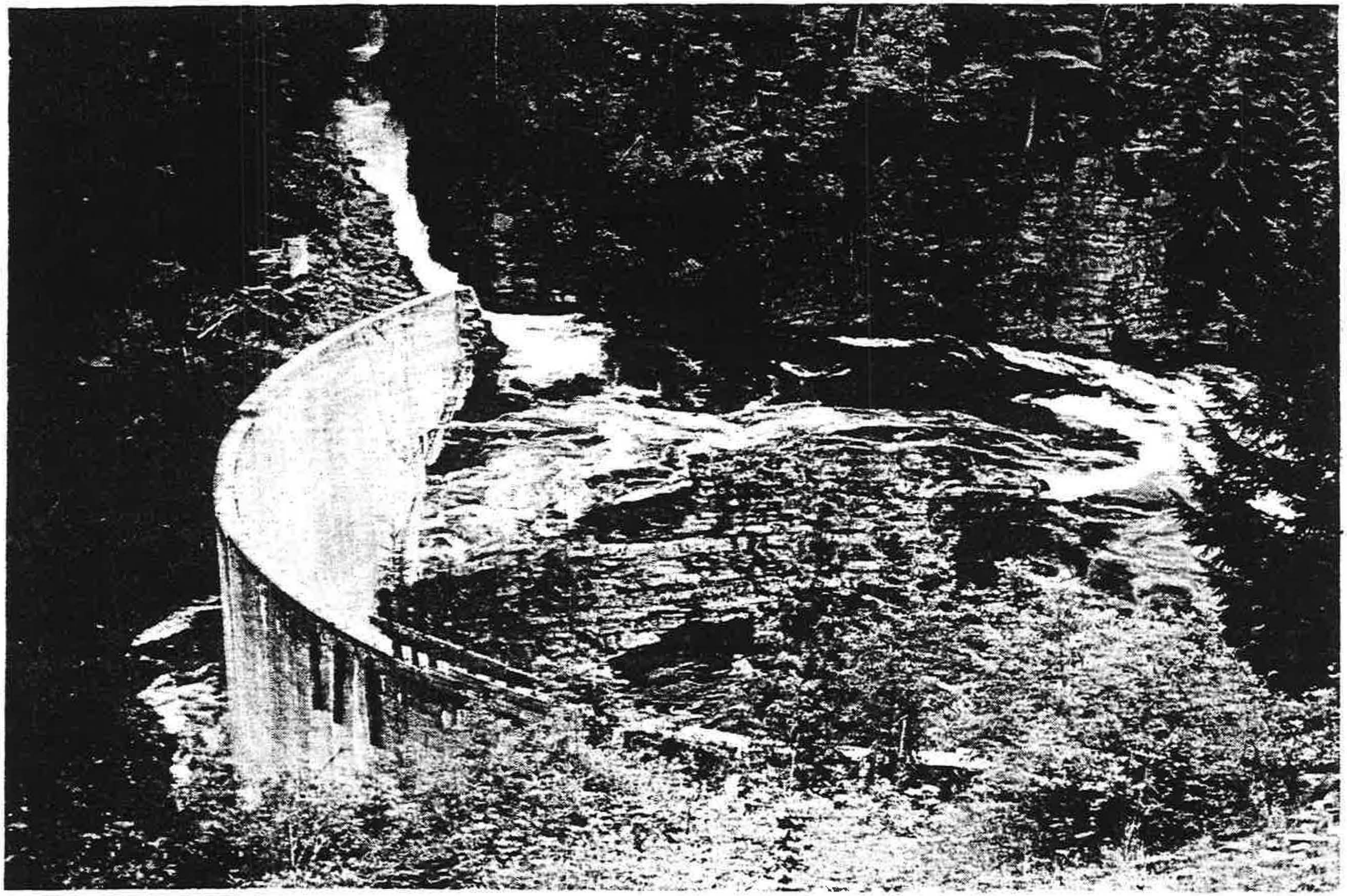
Fire Destroys Eileen Mill

• • • 1921

Fire which started in the boiler room Monday noon while the crew was at dinner completely destroyed the Eileen mill building and shop. Schmidt Bros., the owners, report a loss of $5,000. At present they have a made no plans for rebuilding.

The Eileen mill had a daily capacity of 30,000 feet, and at the time of the fire was producing match stock for the Diamond Match Company.

None of the other buildings were burned, due to strenuous work on the part of the mill crew.



Centennial Photo

Eileen Dam, on the Moyie River, as it looks today. The dam was an early, short-lived attempt to harness the Moyie's energy for electrical power production.

EILEEN

1925 Eileen Dam failure described

One of the best kept local secrets is the history of the Cynide Gold Mining Company's dam near Eileen on the Moyie River.

Not much is known about Eileen, either, except it is now a spot on the map and a good conversation piece. But in the earlier years it was, allegedly, a construction camp complete with commissary and shop. Eileen had a small depot for postal and passenger service on the Spokane International Railway. Major construction of the railroad between Spokane and Eastport was completed in 1906 but Eileen lived long after.

In mid-August 1924, the Cynide Gold Mining Company reported its power plant and dam on the Moyie River near Eileen was ready to operate "with one unit which would develop 325 h.p."

Doomed from the beginning, the project didn't survive the next spring's runoff waters. On Tuesday evening, May 19, 1925, high waters in the Moyie River caused by melting snows, destroyed much of the natural rock formation on which the dam's eastern abutment was anchored. A ten-foot rise in the river was felt four miles downstream at the Bonners Ferry power plant where the waters took out an iron railing on the rock retaining wall below Moyie Falls. Otherwise, there was no damage to the city's plant.

Witnesses at the mining company's dam reported that water pressure from the Moyie flaked shale rock off like shingles from a roof in a wind storm. The dam's forebay, on the upstream side of the dam, soon drained which resulted in the ten foot rise felt downstream. The river had cut itself a new channel at the dam's eastern abutment.

Constructed by the Cynide Gold Mining Company, which also built the power house at the foot of the dam's western abutment and installed one generator, the Eileen dam was an "arch dam." Arch dams do not fail, and neither did the Eileen fail because it was an arch dam. An engineering design error of placing the eastern abutment on shale rock lead to the disaster.

Below the dam near the bottom of its eastern abutment, Skin creek, with headwaters in Montana near Windy Pass, tumbles into the Moyie river.

In a way, the Cynide Gold Mining Company's dam is a monument to the ingenuity of local citizens who pioneered harnessing the Moyie River for electricity. They just made that one mistake...

Equivalent Human Energy
For One Generator

1. Assume one person can carry 4 gallons of water per trip and climb from the river level to lake level and return once every 30 minutes.

    Water flow per unit= 5000 CFS
    = 37,500 gal/sec
    = 2,500,000 gal/sec
    = 135,000,000 gal/sec

    One person can carry 8 gal/HR

    In order to return the water from the river to the reservoir over 16,000,000 people would be required for every hour of the day. (For each unit running).

    - Points out the inefficiency of human labor and the amount of human labor available from each generator.
    - Generators are approximately 90% efficient.

2. Grand Coulee Dam equals 13 Libby Dams.
3. Mt. Saint Helen's blowing for 9 hr. period equals 100,000 Libby Dams.
4. Would take 1,020,000 people or 643,690 horses to equal the power of one Libby Dam.
5. An individual person can produce approximately .5 KWH/day.
6. One generator will produce 120,000 KWH/HR or 2,880,000 KWH/day.
7. Equivalent people days: 240,000 people per hour and 5,760,000 people per day.

DAM QUIZ

Match the lettered descriptions with the numbered words.

_____ A. The height of the reservoir above a turbine inlet at any given time. Libby Dam operates most efficiently when the height is 300 feet: Albeni Falls Dam at 22 feet.

_____ B. A steel tube through the dam for carrying water from the reservoir to the turbine. Each tube at Libby is 20 feet in diameter.

_____ C. A gate used to regulate flow of water into the turbines. These gates determine the amount of electricity produced.

_____ D. A machine which converts the flow of water into mechanical power to spin the shaft and rotor. The power produced is the same as 165,000 horsepower.

_____ E. The moving part of a generator which is surrounded by a magnetic field. At Libby Dam this part spins at 128.6 rpm; 54.5 rpm at Albeni Falls Dam.

_____ F. A series of copper conducting wires contained in windings which break the magnetic field of the rotor. There are over 86 miles of copper wires in each generator.

_____ G. A machine used to produce electricity by rotating a magnet within a winding of copper wires.

_____ H. The electromotive force needed to push a current through a wire.

_____ I. A measure of the strength by which electrons flow.

_____ J. A measure of the electric power produced by one volt of force times one current of flow.

_____ K. The use of 1,000 watts (or ten 100 watt bulbs) for one hour. Libby Dam generators can produce 120,000. Albeni Falls Dam 16,300.

_____ L. One million (1,000,000) watts.

_____ M. A united States government agency. This agency markets the power produced at both Libby and Albeni Falls Dams.

1.	BPA	6.	STATOR	11.	GENERATOR
2.	VOLT	7.	TURBINE	12.	WICKET GATE
3.	WATT	8.	AMPERE	13.	KILOWATT HOUR
4.	HEAD	9.	PENSTOCK		
5.	ROTOR	10.	MEGAWATT		

Answers on Back Page

ANSWERS TO DAM QUIZ:

A.4 B.9 C.12 D.7 E.5
F.6 G.11 E.2 I.8 J.3
K.13 L.10 M.1

RATING: (Number Correct):

10-13	Dam Expert
05-09	Dam Knowledgeable
01-04	Dam Poor
0	Dam Dumb

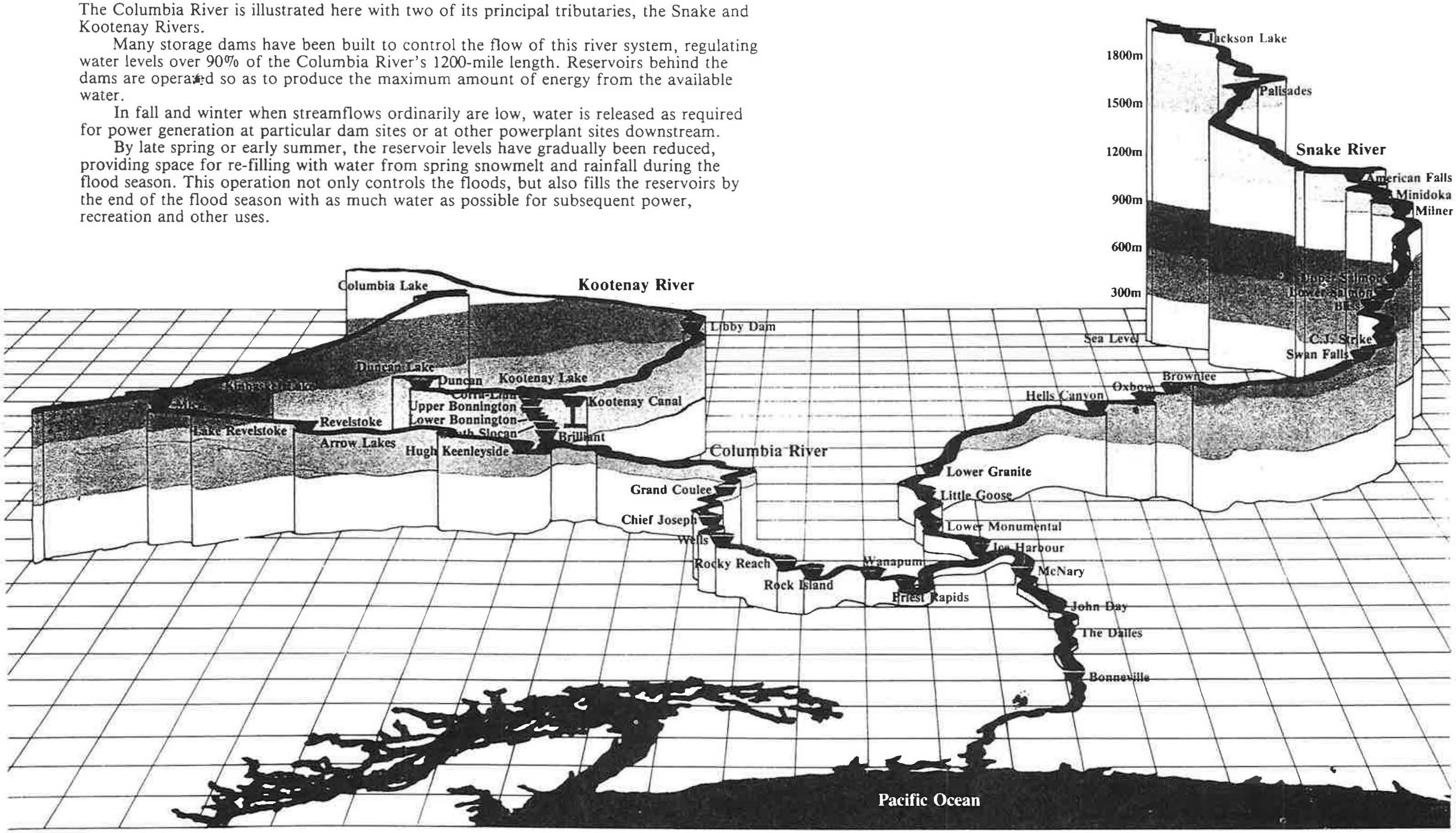
The Columbia River and its Tributaries

The Columbia River is illustrated here with two of its principal tributaries, the Snake and Kootenay Rivers.

Many storage dams have been built to control the flow of this river system, regulating water levels over 90% of the Columbia River's 1200-mile length. Reservoirs behind the dams are operated so as to produce the maximum amount of energy from the available water.

In fall and winter when streamflows ordinarily are low, water is released as required for power generation at particular dam sites or at other powerplant sites downstream.

By late spring or early summer, the reservoir levels have gradually been reduced, providing space for re-filling with water from spring snowmelt and rainfall during the flood season. This operation not only controls the floods, but also fills the reservoirs by the end of the flood season with as much water as possible for subsequent power, recreation and other uses.



A turbine is a device with a rotor turned by a moving fluid such as water. A turbine changes kinetic energy (energy of movement) into mechanical energy (energy in the for of mechanical power). Mechanical energy is transmitted by a turbine through the spinning motion of the rotor's axle. Turbines provide power for a variety of machines, including electric generators. In fact, generators driven by turbines produce most of the electricity used to light homes and run factories.

The earliest known turbines date back to simple water wheels used by the ancient Greeks about 2,000 years ago to grind grain and squeeze oil from olives. By 30 A.D., the Romans had introduced water wheels into many parts of Europe. For many centuries, water wheels and windmills were the only useful turbines. The scientist Hero of Alexandria had built a small steam turbine about 60 A.D., but it was not used to power anything.

Early water wheels were less efficient than modern turbines, because much of the moving fluid escaped around the edges of the blades. During the 1800's, engineers and inventors began developing more efficient, enclosed turbines. In 1824, Claude Burdin, a French engineer, introduced the word turbine in a scientific paper. It comes from the term turbo, the Latin word for a spinning object. Benoit Fourneyron, another French engineer, built the first successful enclosed water turbine in 1827.

After Fourneyron's success, engineers soon overcame most of the problems that were involved in building efficient water turbines. In 1849, an English-born inventor named James B. Francis built the first Francis turbine. His design enclosed a water wheel in a steel casing. By surrounding the water wheel with a steel casing, all of the force of the flowing water is directed to the fins on the turbine. The moving water then does not escape around the edges of the fins.

Turbines are more commonly classified by the type of fluid that turns them. The ones at Libby Dam are water turbines. Water turbines are also called hydraulic turbines. The water stored behind Libby Dam drives the turbines in the powerhouse. The turbines built by Allis Chalmers power the Westinghouse electric generators of Units One through Five.

The type of water turbine used at a dam depends on the head. A head is the distance the water falls before it strikes the turbine fins. The Francis turbine is used when the head is between 100 feet to 1000 feet. The turbines at Libby Dam operate most efficiently with a head of 300 feet. A Francis turbine's rotor is enclosed in a casing, or scroll casing. It's wheel has as many as 24 carved fins. Its axle is vertical. The wheel operates underwater. It is encircled by a ring of guide vanes (wicket gates), which can be opened or closed to control the amount of water flowing past the wheel. The spaces between the vanes, or gates, act as nozzles to direct the water toward the wheel's center. The rotor is turned chiefly by the weight or pressure of flowing waters.

HYDROPOWER

Water power is a valuable source of energy. The earth's constant flow of water can be harnessed to produce useful mechanical and electrical power. The first water-powered plant for generating electricity was built in Appleton, Wisconsin, in 1882. This hydroelectric plant established water power as an important source of electricity. Hydroelectric power is now used all over the world. Today, almost all water power is used to generate electricity.

Hydroelectric power plants generate about 20 per cent of the world's electrical power and around 5 per cent to 10 per cent of the electricity produced in the United States. Here in the Northwest approximately 75 per cent of our electricity is produced by hydropower. Just over 50 per cent of that electricity is generated by dams in Washington, Oregon, Idaho, and Montana.

Hydroelectric power plants convert the energy of falling water into electrical energy. These plants use water that is stored in a reservoir behind a dam. Water cannot create power unless it is flowing from a higher place to a lower place as in a dam. People use the effects of gravity (the attraction the earth exerts on an object) pulling the water downward when they harness water for power.

A dam is a barrier placed across a river to stop the flow of water. A dam stores water, creating a lake or reservoir above it. The stored water is then made available for many uses, including hydropower. This stored water flows through hydraulic turbines producing electric power used in homes and industries.

Dams are classified by the material used to construct them. Concrete gravity dams, such as Libby Dam, depend entirely on their own weight to resist the tremendous force of the oncoming water. For example, the 3.8 million cubic yards of concrete in Libby Dam weighs 7.6 million tons. These dams are the strongest and most massive dams built today. A gravity dam is built on a solid rock foundation. The dam transfers the force of water downward to the foundation below. Gravity dams can hold back enormous amounts of water. For example, Lake Koocanusa behind Libby Dam can store 5.8 million acre feet, or 2 trillion gallons of water.

The Egyptians built the earliest known dams on the Nile River about 2800 B.C. The ancient Romans built dams of cut stone throughout the Roman Empire. Some of those dams built by the Romans are still in use today. The earliest dams in North America provided power for grist mills and sawmills. American colonists probably built the first dam in 1634 to operate a sawmill in South Beerwick, Maine. In the 1800's, significant advances were made in the design and construction of masonry dams. During the 1900's, improvements in engineering techniques and building materials led to the construction of higher and longer dams than ever before.

In the customary system of measurement, a cubic foot of water weighs 62.4 pounds. The pull of gravity then creates a pressure of 6,240 pounds per square foot at the base of a body of water 100 feet tall. If this water were released from a nozzle, such as a wicket gate, at the bottom of the source, the stream of water would travel at a speed of about 80 feet per second. The force of this stream striking a set of turbine fins would cause the turbine to rotate, producing mechanical energy.

An electric generator is a machine that produces electricity. Generators produce almost all of the electricity used by people. Generators were once called dynamos, a shortened form of the term dynamoelectric.

A generator does not create energy. It changes mechanical energy into electrical energy. Every generator must be driven by a turbine, a machine that produces mechanical energy. Engineers often use the term prime mover for the turbine that provides the mechanical energy that drives a generator. To obtain more electrical energy from a generator, the prime mover must supply more mechanical energy.

Generators produce electricity by mean of a principle discovered independently by two physicists in 1831. Michael Faraday of England and Joseph Henry of the United States. Faraday and Henry found that they could produce electricity in a coil of copper wire by moving the coil near a magnet, or by moving a magnet near the coil. This process is called electromagnetic induction. The voltage, or electromotive force, of the electricity produced is called an induced voltage or induced electromotive force. If the wire is part of a closed circuit of wires, the induced voltage causes an electric current to flow through the circuit.

A simple generator would consist of a U-shaped magnet and a single loop of wire. The area around a magnet where its force can be felt is called a magnetic field. A magnetic field can be thought of as lines of force going out from the north pole of a magnet and returning into the magnet at its south pole. The stronger the magnet, the greater the lines of force. If you rotate a loop of wire between the poles of the magnet, the two sides of the loop "cut" the lines of force. This induces (generates) electricity in the loop. For every complete turn, the voltage and current that are generated travel in one direction half the time, and in the opposite direction the other half of the time. Twice during each turn no current flows.

One complete revolution of the loop through the lines of force is called a cycle. The number of such cycles in a second is called the frequency of the voltage or current and is measured in units called hertz. One hertz equals one cycle per second. The generators at Libby Dam produce 60 cycle, 3-phase alternating current at 13,800 volts.

When a loop of wire is rotated between the poles of a magnet it produces another important electromagnetic effect in addition to generating electricity. When the loop of wire carries current, the current produces a magnetic field of the magnet.

It makes the loop harder to turn. The more electricity induced in the loop, the stronger its magnetic field, and the more difficult it is to turn. That is why the prime mover that turns a generator must furnish increased amounts of mechanical energy to increase the output of current by the generator.

Not all of the mechanical energy used to drive generators is converted to electrical energy. Some of it is converted to heat as a result of friction in the bearings supporting the generator rotor, the resistance of the copper coils to the current, and the action of the magnetic lines of force in the iron cores. The generators at Libby Dam are cooled by running coolant water through tubes to cool the oil in the main bearings. Also the rotor when turning acts like a fan and forces air through the stator coils and then past a series of radiators that have coolant water running through them. Once cooled, the air is recirculated past the coils and then through the radiators in a continuous process.

A generators efficiency refers to its effectiveness in converting mechanical energy to electrical energy. An efficiency of 94 per cent, like the generators at Libby Dam, means that 94 per cent of the input mechanical energy is converted to heat and must be carried away by the cooling system.

The main generators in nearly all electric power plants, like the Libby Dam Powerhouse, are AC generators. The is because a simple electromagnetic device called a transformer makes it easy to increase or decrease the voltage of alternating current. Engineers build AC generators that produce current with only a certain voltage. By means of a step-up transformer, the voltage can be increased. At Libby Dam the transformers outside the powerhouse step-up the voltage to 240,000 volts. When the voltage is increased, the resistance, or amperage, is decreased. This allows the current to be sent over long distances. In the area where the current is finally used, for example the substation located near Libby, a series of step-down transformers lower the voltage to a usable level.

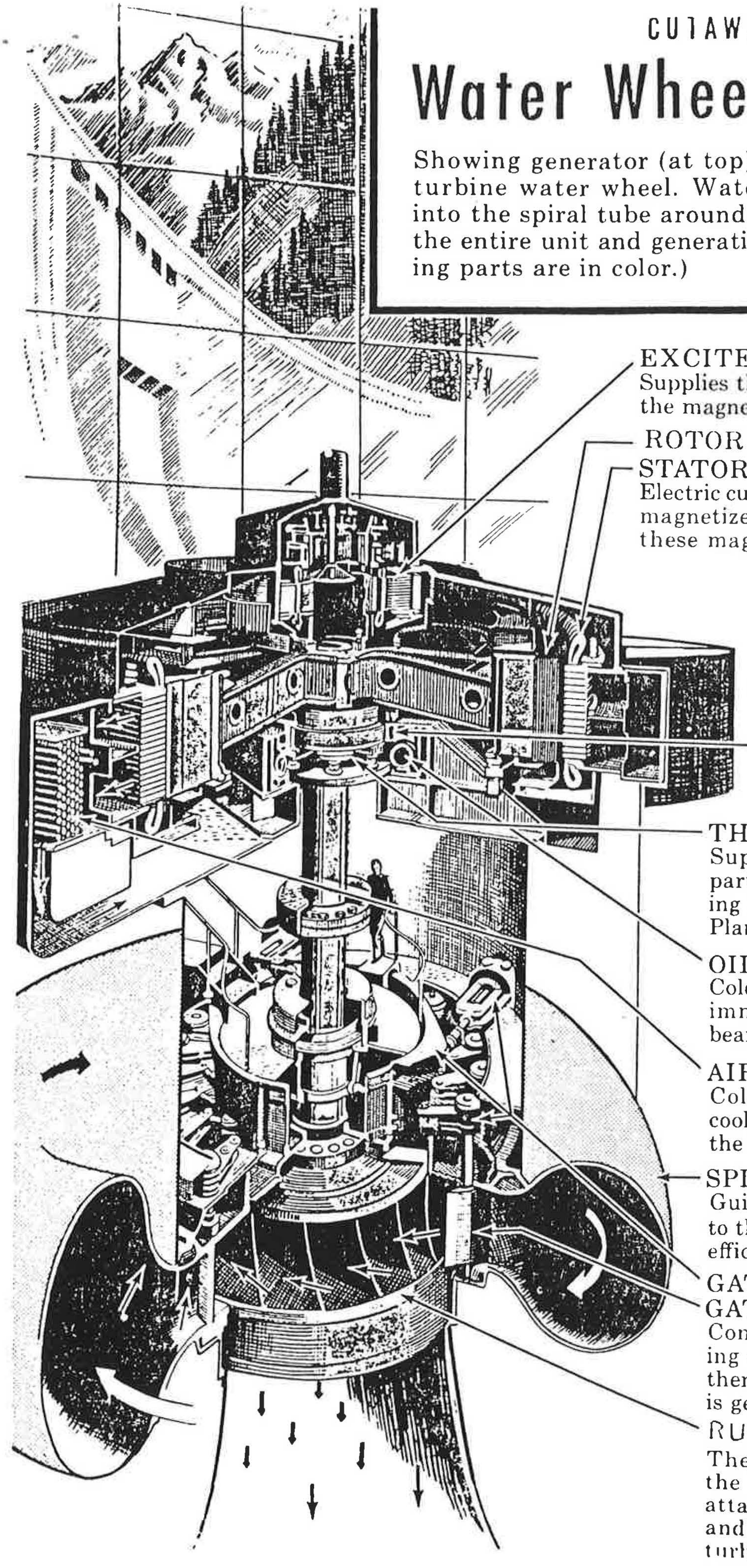
Nikola Tesla, a Serbian engineer who came to the United States in 1884, developed the first successful polyphase AC generators, or generators with more than one phase. The units at Libby Dam are three phase, or polyphase, generators. He also developed transformer systems for changing the voltage of alternating current. Tesla's inventions made it economically possibly to generate current far from the places where the current is used. For example, some of the power generated here at Libby Dam can be sent over the Bonneville Power Administration transmission lines to Portland or Seattle.

Most electricity travels from power plants along overhead wires called transmission lines. As electric current moves along transmission lines, the lines resist the current flow. The resistance causes the current to lose energy. Power plants limit energy losses by transmitting electricity at high voltages. As voltage is increased, the amount of current needed to transmit a particular amount of electric power decreases. Because less

CUTAWAY OF

Water Wheel Generator

Showing generator (at top) and connecting shaft to turbine water wheel. Water flows at high pressure into the spiral tube around the water wheel, turning the entire unit and generating electricity. (The rotating parts are in color.)



EXCITER
Supplies the electric current used to produce the magnetic field in the rotor field coils.

ROTOR FIELD COILS
STATOR WINDINGS
Electric current flowing through the field coils magnetizes the iron cores or field poles. As these magnetic fields are rotated past the wires in the stator windings, it causes alternating current to flow in them. This is the power that is sent out to the consumer. (The rotor and the stator together make up the generator.)

GUIDE BEARING
Keeps the rotor in line.

THRUST BEARING
Supports the weight of the rotating parts. (Rotor and turbine of generating units at Seattle City Light's Ross Plant weigh 460 tons.)

OIL COOLER
Cold water is run through copper pipes immersed in the oil surrounding the bearings to keep the bearings cool.

AIR COOLER
Cold water is run through pipes to cool the air which is circulated through the machine to cool the windings.

SPIRAL CASING
Guides the water from the penstock to the runner to achieve the most efficient use of its force.

GATE MECHANISM
GATES
Controls the amount of water entering to the runner or water wheel and thereby the amount of power the unit is generating.

RUNNER (WATER WHEEL)
The force of the falling water turns the runner and the generator rotor attached to it. (The gates, the runner and the spiral casing make up the turbine.)

Energy is required to produce electricity

Essentially, all energy that man converts to useful work is of nuclear origin. This is because the sun is the earth's one energy source of any consequence. Converted energy, whether from coal, oil, natural gas or falling water, originated in the sun.

Electricity is one form of energy. No useful supply of electricity exists in nature. To produce it, man must take energy from one or more of its natural sources and convert it to electricity. Much complicated and costly equipment is required to do this on a commercial scale. But the basic principle is simple.

A permanent magnet has two poles, north and south. The invisible force in the magnet which attracts and repels is always present between and around the poles. These unseen lines of force emanate from the north pole, and return to the magnet at the south pole.

If a good conductor of electricity, such as copper or aluminum wire, moves in such a way that it cuts across these magnetic lines of force, an electrical force or 'voltage' will be created or 'generated' in the conductor.

This is the basic principle of electric generation. Whether the operation is small or large, the basic principle applies.

Some form of energy is used to turn a wheel. The wheel turns a shaft. Housed near the top of the shaft is an immensely powerful electro-magnet, which is activated by the spinning shaft. Conductors cutting the magnetic field of the magnet pick up electricity. The electricity flows through the conductors in turn to transformers, to transmission lines, to substations, to local distribution lines, to your home.

Simple enough in principle — but surprisingly sophisticated in practice.

Hydro plants No. 1 source of power

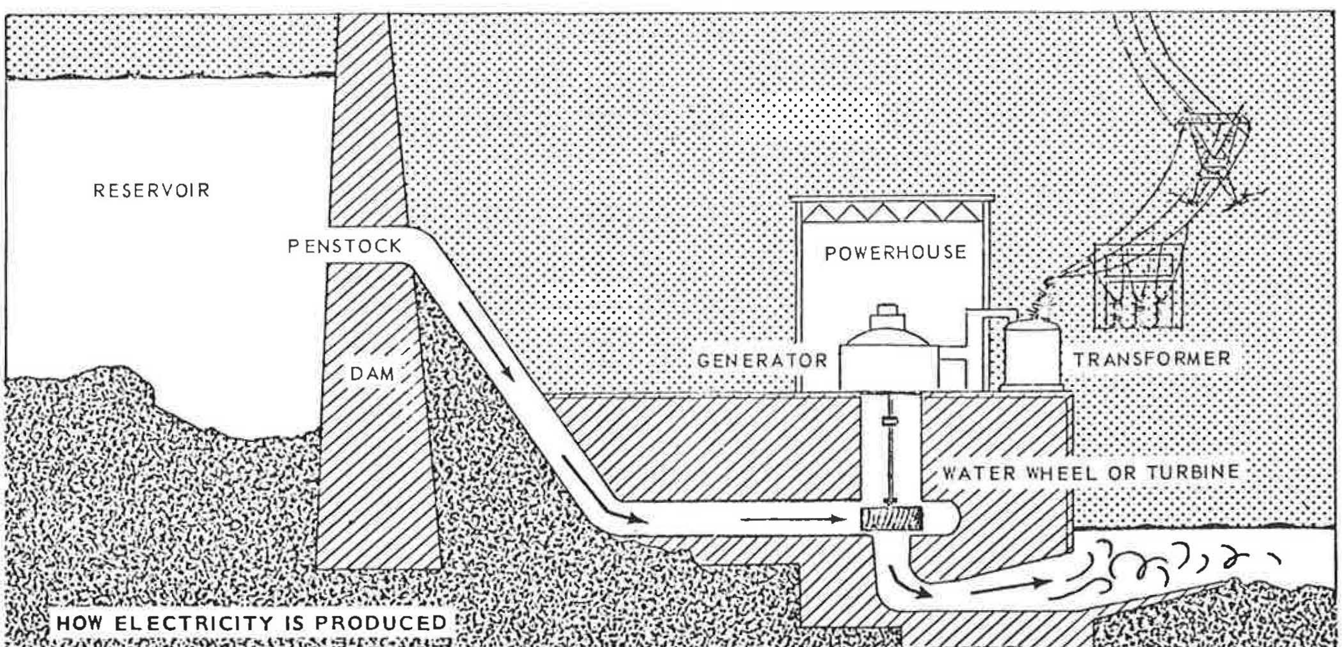
Several methods of generating electricity are used by B.C. Hydro. By far the most important today is hydro power. There are many reasons for this. British Columbia has enormous and well distributed resources of water power. While capital costs for construction of dams and plants are very high, there is no fuel cost, and operating and maintenance costs are low. Life expectancy is high Over a period of years this is the most economical way to produce electricity.

Thermal generation using fossil fuels requires a lower initial capital outlay, but involves higher operating costs. Fuel has to be purchased on a continuing basis, probably at steadily rising cost.

Diesel generating stations are easily installed, and relatively cheap to operate, but because of limited capacity are usually used to supply small, isolated communities. Gas turbine plants use cheaper fuel than diesel engines, and as they are built in larger sizes, can produce more power. But they are less efficient, and comparatively short-lived. Maintenance is higher than diesels, particularly for start-stop operation.

Nuclear generation is today receiving a great deal of study and attention. With continuing development it seems probable that nuclear energy will become increasingly important in meeting future power needs. B.C. Hydro is following this development with keen interest — mindful of British Columbia's needs perhaps 10, 15 or 20 years from now.

Large as Hydro's generating capacity is today, it must be increased each year to meet skyrocketing demand. Consumption of electric power in B.C. Hydro's service area more than DOUBLED during the last six years.

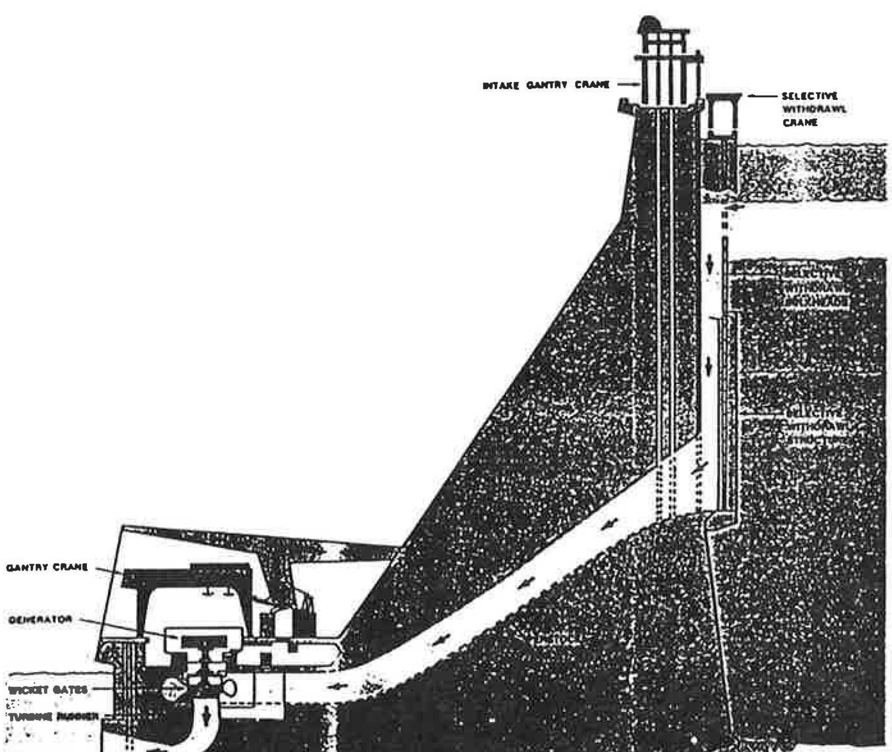


The cut-away drawing above shows in elementary form how electricity is produced. In this case hydro power is supplying the energy to turn the turbines. Giant size of a turbine installed in the vast underground powerhouse at Gordon M. Shrum Generating Station on the Peace River is shown on front cover.

current flows through the lines, there is less energy lost due to resistance. It is also easier to boost the voltage of AC, therefore making AC easier to transmit. That is why power plants generate AC.

Hydroelectric power is now used all over the world. Today, almost all water power is now used to generate electricity. Hydroelectric plants are especially useful for producing electricity during periods when it is in great demand, because the generators can be turned on and off quickly. World potential of water power is estimated at over 2 billion kilowatts of electricity. Of this potential, about 500 million kilowatts has been developed. The United States has about one-sixth of the world's developed water power. Canada and Europe have most of the rest of the developed hydropower.

Selective Withdrawal System and Hydropower Production



Water that flows through the turbines can be drawn from various lake levels in order to partially control downstream water temperatures. This is needed during warm summer months to benefit the downstream fishery.

If cooler temperatures are needed, bulkheads are removed from their slots in the withdrawal system, allowing water to be drawn from deep in the lake. For warmer water, bulkheads are added, allowing water nearer the lake surface to be drawn into the system.

From the selective withdrawal system, water flows down through the penstocks and turbine runners on its way to the river below the powerhouse. The tremendous force of the falling water impells the turbine blades. The turbines develop 165,000 horsepower, their steel shafts spinning the rotors in the generators above. The rotors support a series of large magnets, and as the rotors turn, the revolving magnetic fields cross the stationary copper wire coils in the stators, and electrical energy is produced.

One cubic foot of water falling 14 feet supplies the necessary energy to produce one kilowatt of electricity. The generators in operation at Libby Dam produce enough power in a year to supply the residential needs of a city of 380,000, about 12 times the size of Missoula, Montana.