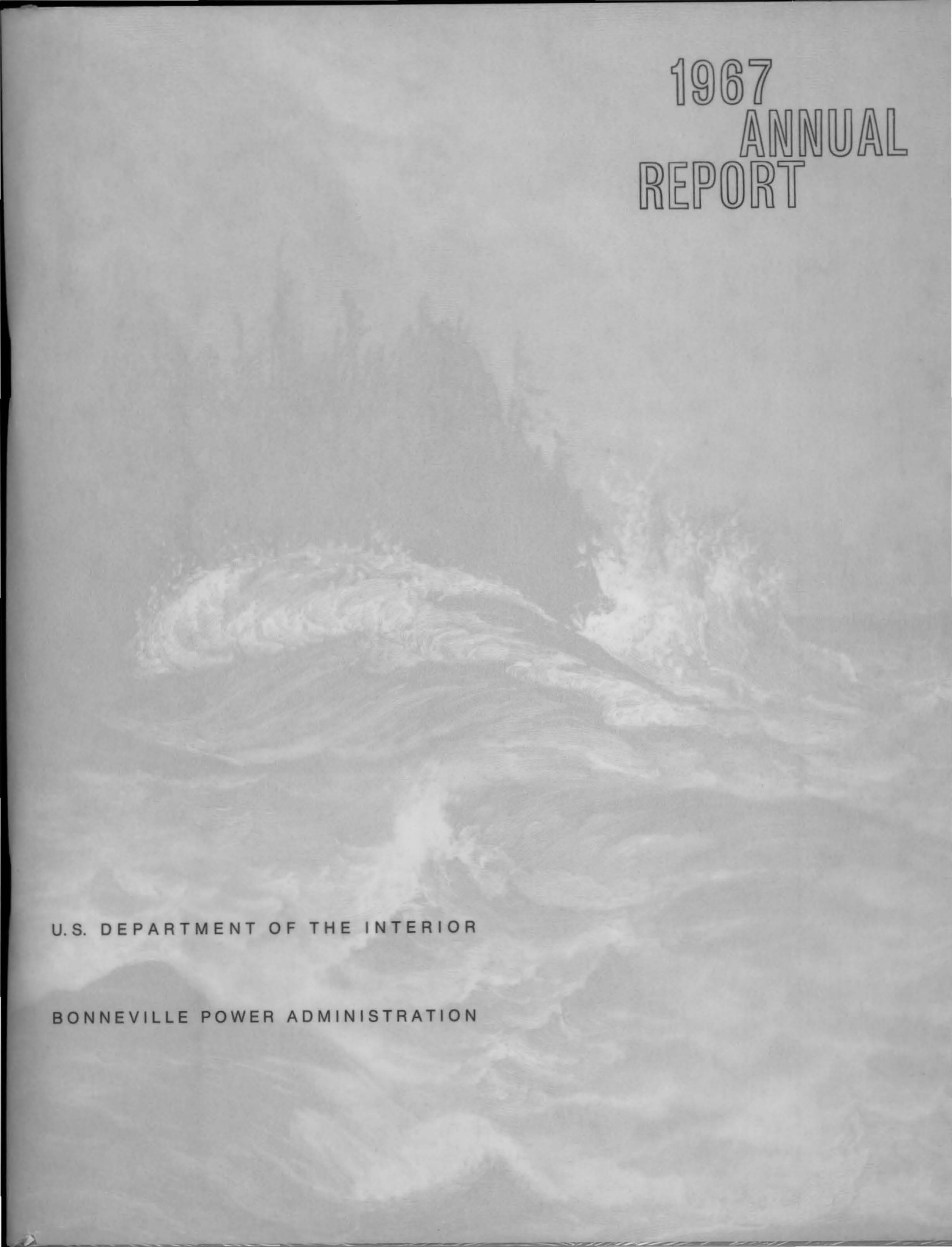
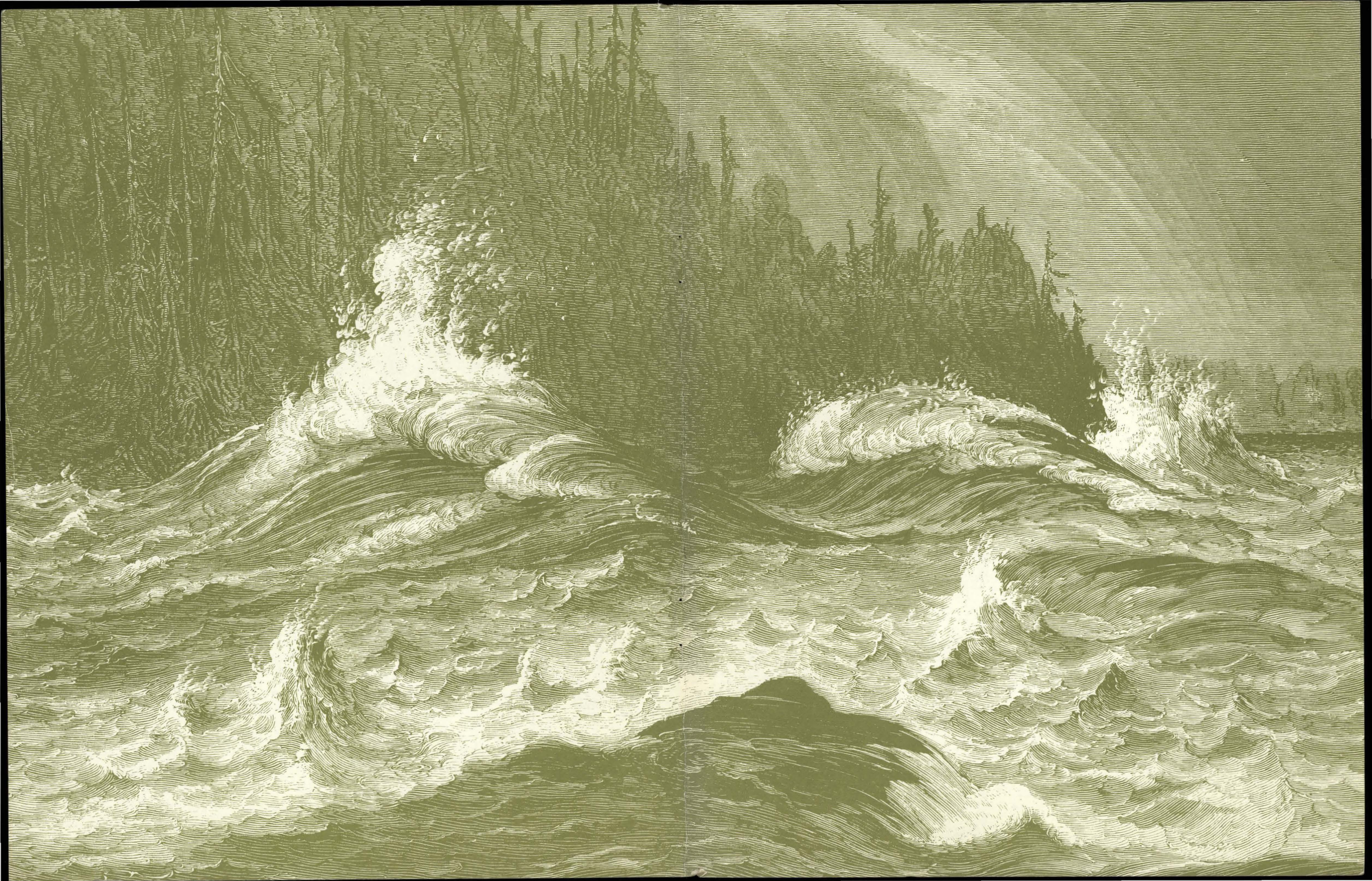
1967 ANNUAL REPORT



U.S. DEPARTMENT OF THE INTERIOR

BONNEVILLE POWER ADMINISTRATION



DECEMBER 1967

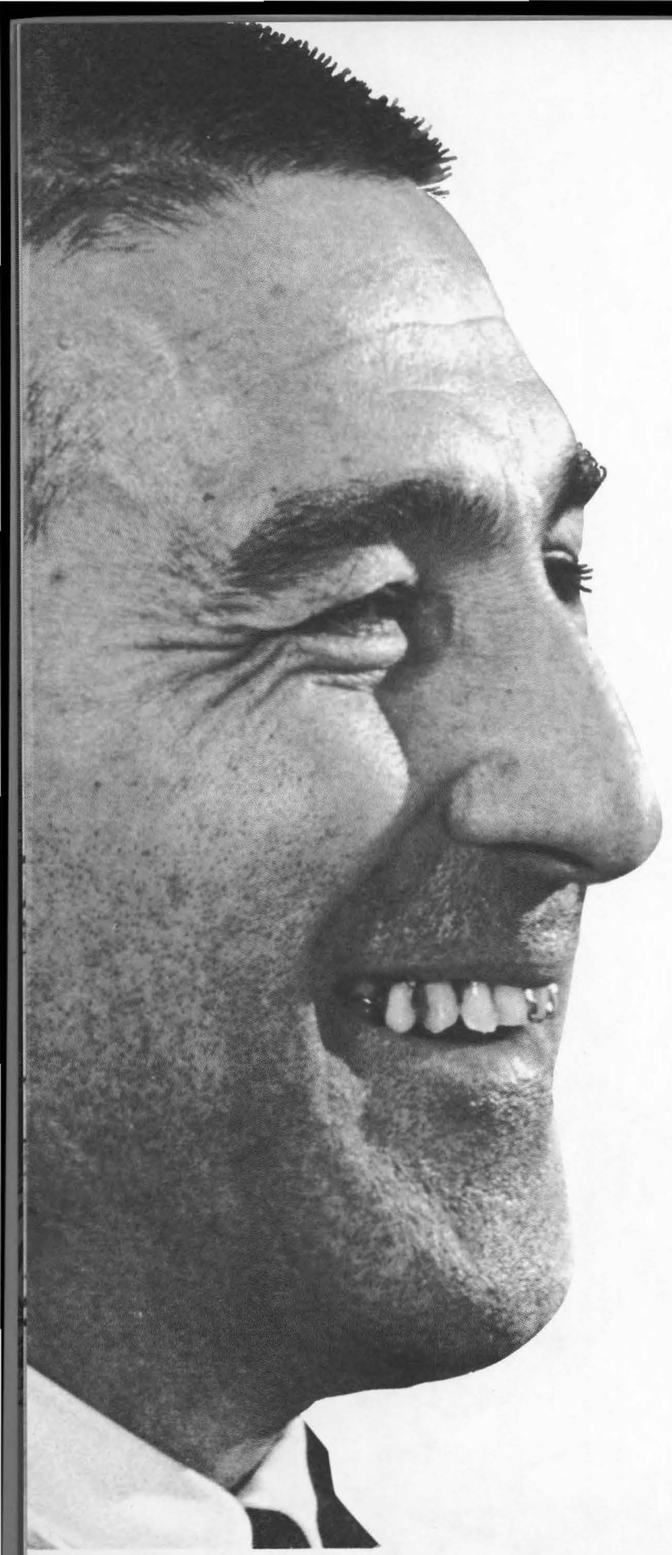
The prints of century old wood engravings on the inner and outer covers show the Columbia Basin in its wilderness days

U. S. COLUMBIA RIVER POWER SYSTEM

1967 ANNUAL REPORT

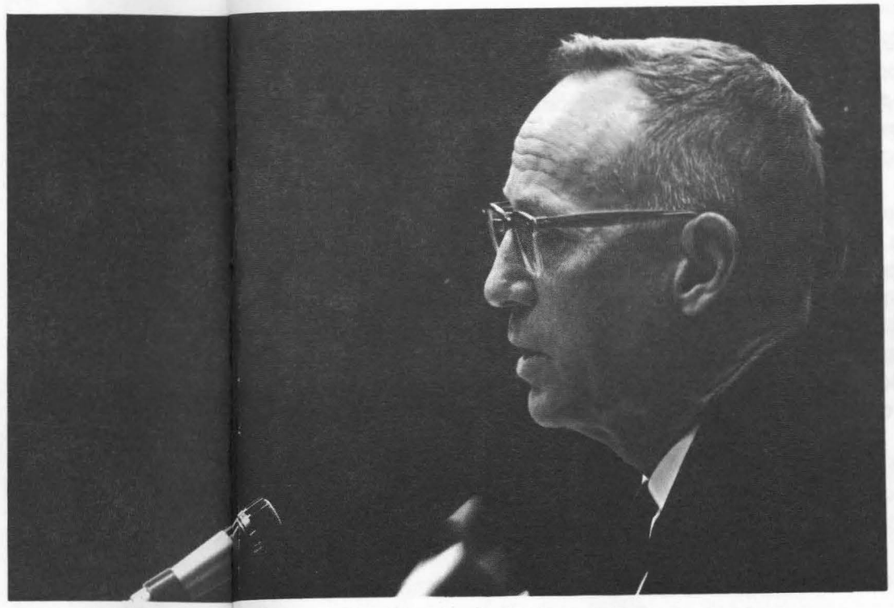
U. S. DEPARTMENT OF THE INTERIOR
Stewart L. Udall, Secretary

BONNEVILLE POWER ADMINISTRATION
H. R. Richmond, Administrator



Secretary Udall

Letter to the Secretary



Mr. Richmond

Mr. Black

December 31, 1967

Honorable Stewart L. Udall
Secretary of the Interior
Washington, D.C. 20240
Dear Mr. Secretary:

During the 11 months prior to taking up my present duties as Under Secretary of the Interior, I was privileged to serve as Administrator of the Bonneville Power Administration. My term as Administrator coincided roughly with the 1967 fiscal year.

Public Law 89-448 of 1966, which authorized the third powerhouse at Grand Coulee Dam, also repealed Subsection 9(c) of the Bonneville Project Act, which had required an annual report each December. It substituted in lieu thereof a requirement for an annual financial statement on a payout basis. In accordance with the practice established last year, this report will meet the new requirement and also contain additional information on our operations, including financial statements prepared on a cost-accounting basis. Herewith, then, is the 30th annual report of the Bonneville Power Administration.

This transmittal letter reports highlights of fiscal year 1967. In a separate letter, the new Administrator, Henry R. Richmond, sets forth his major goals for Bonneville.

A GENERATION OF ACHIEVEMENT

First, however, in view of a significant 30th anniversary just past, I think it appropriate to make brief mention of Bonneville's beginnings and its three decades of contributions to the national and regional economy.

When President Franklin D. Roosevelt signed the Bonneville Project Act into law on August 20, 1937, the population of the Pacific Northwest was about 3 million. Today it is double that figure. In 1937, the average residential consumer in the region used approximately 1,200 kilowatt hours of electricity a year. Today he consumes 12,000 kilowatt hours a year.

Bonneville started by marketing power from a single dam—Bonneville Dam, just up-river from Portland. Today it is the marketing agent for 22 Federal dams in the Columbia River Basin and is also the designated marketing agent for 8 new Federal dams under construction or authorized in the Pacific Northwest. The first transmission line built by Bonneville was a 3.4 mile 13,800-volt line from Bonneville Dam to the City of Cascade Locks. Today Bonneville has more than 10,000 circuit-miles of transmission lines in operation at voltages as high as 500,000 volts.

Bonneville's revenues in its first fiscal year were $49,835. In fiscal year 1967, U.S. Columbia River Power System revenues were in excess of $112 million. Cumulative revenues to date exceed $1⅓ billion.

The establishment and growth of the U.S. Columbia River Power System have been widely recognized as the greatest single factor in the expansion and diversification of the Pacific Northwest economy.

THERMAL PLANT PLANNING

Bonneville's most significant contribution during fiscal year 1967 was the agency's assumption of leadership in organizing regionwide planning for the 15 or 16 million kilowatts of thermal generation the Pacific Northwest will need in the next 20 years.

Extensive coordinated planning is required because of the complex legal, financial, technological, and marketing problems involved. Therefore Bonneville has fostered the organization of the region's utilities, both publicly and privately owned, into a Joint Plant Power Planning Council designed to effect a smooth and economic transition from the all-hydro era to an era of combined hydro and thermal development.

Bonneville is the only agency whose direct responsibility involves electric power service to the entire region. Only the Federal system can provide the backup generation and transmission reserve capacity needed by large thermal plants. The agency's leadership obligation is obvious.

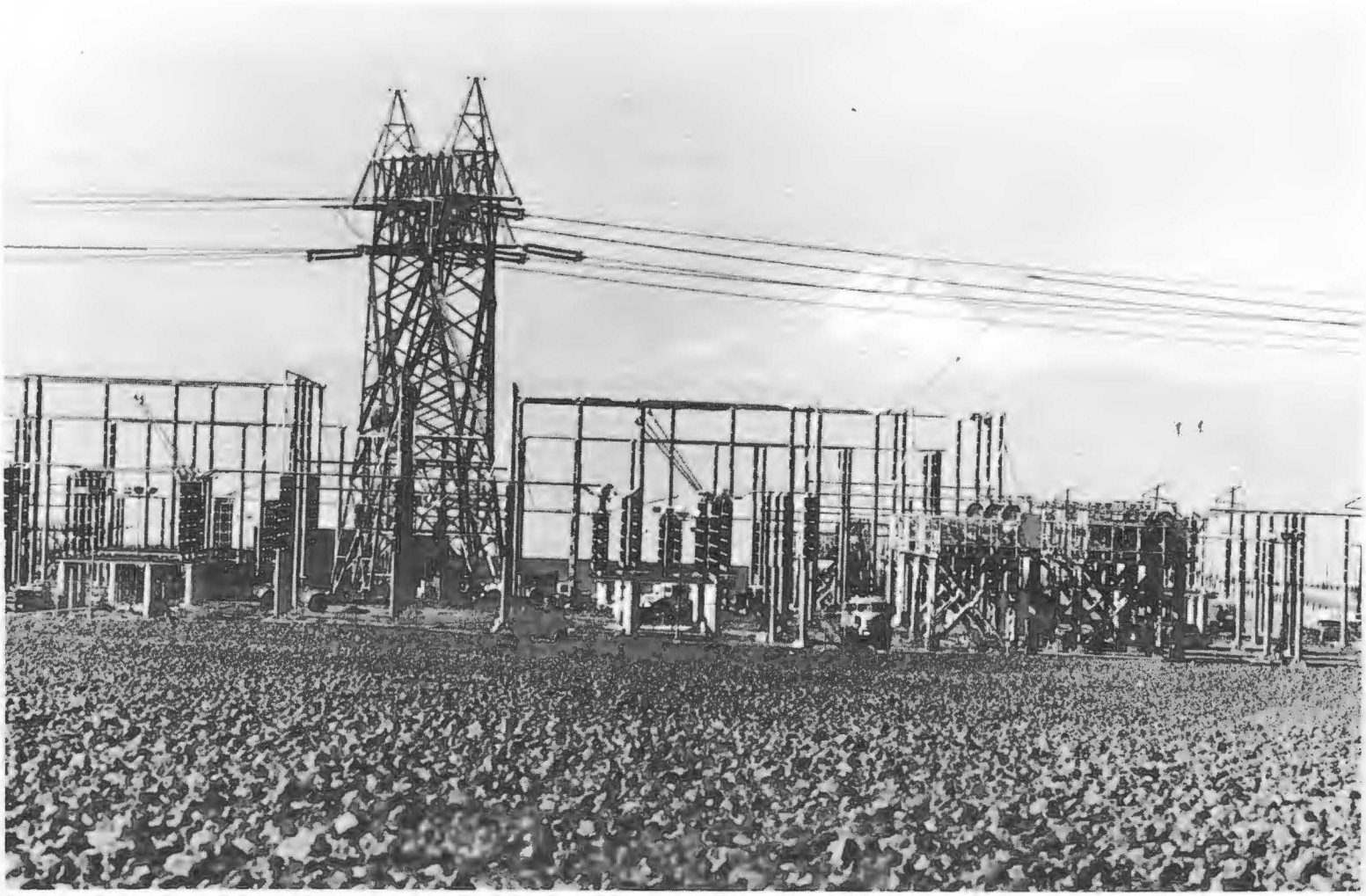
The progress of the Planning Council to date and the continuing public interest in the Council's activities are indicative, I feel, of eventual success in meeting the region's massive power needs in an efficient and economical manner.

REVENUES

Revenues of the U.S. Columbia River Power System for fiscal 1967 reached $112.2 million, an all-time high. Bonneville's utility customers showed steady growth. The increase in total revenues was 8.8 percent over the previous year, with the largest gains made in sales to privately owned utilities, which were up 36.8 percent, and to the aluminum industry, up 15.5 percent.

PAYOUT PROGRESS

In fiscal year 1967, Bonneville applied about $38 million to repayment of the power system investment. This was after paying $35.6 million in interest costs and $38.6 million in operation, maintenance, and general expenses. These payments brought the total repayments of power costs from the beginning of operations through June 30, 1967, to about $1.37 billion, of which $0.49 billion has gone for repayment of the investment in the power system; $0.47 billion has been applied to interest costs; and $0.41 billion has gone for operation and maintenance costs. Bonneville's most recent repayment studies indicate that its rates continue to be adequate to meet all repayment obligations on schedule.



Bakeoven Capacitor Station

SALES

Bonneville sold a record 44 billion kilowatt-hours of energy in fiscal 1967—an 11 percent increase over 1966. The average price of the power was 2.38 mills a kilowatt-hour.

About 42 percent of the total energy sold went to 104 publicly owned utilities, 13 percent to 8 private utilities, 34 percent to aluminum plants and 10 percent to other industries and Federal agencies.

Bonneville now has committed nearly all of the firm power it can sell to industry until additional power sources are assured. This fact ought to be of continuing concern to everyone interested in the economic future of the Pacific Northwest.

CONSTRUCTION

Fiscal 1967 was the greatest construction year in the history of the U.S. Columbia River Power System. The number of operating Federal dams rose to 22 in June with the completion of Green Peter on the Middle Santiam River in Oregon. Federal installed capacity in the Columbia system now totals 6,758,150 kilowatts. Eight Federal dams under construction have a total nameplate rating of 8,552,000 kilowatts. Authorized additional capacity at Grand Coulee and The Dalles Dams will add 4,288,000 kilowatts of Federal generation. Non-Federal utilities plan to add 2,655,850 kilowatts at projects under construction or licensed.

To keep pace with the region's growth in generating capacity and to improve reliability, Bonneville extended its network of long-distance high-voltage lines during fiscal 1967 to more than 10,000 circuit miles. Projected demands for firm power in the Pacific Northwest over the next decade leave no margin for slippage in either generating or transmitting facilities.

The most critical elements of Bonneville's present construction program are increments to the 500-kv grid upon which virtually the whole of the Northwest depends for the transmission of its bulk power supply. The approximately 600 miles of 500-kv lines in the system today must be extended to some 2,500 miles by 1973.

In order to minimize adverse impact on the landscape and because of the significant economies of scale, it is vital that we take fullest advantage of the technology of extra-high-voltage long-distance transmission. This is the only way to prevent an endless proliferation of overhead power lines through our forests, mountains, and deserts.

INTERTIE

If I may extend the reach of this letter a bit into fiscal 1968 and the first few months of Russ Richmond's administration of Bonneville, I can report that the first portion of the first 500-kv Pacific Northwest-Pacific Southwest Intertie line was energized on September 20 and that the entire line, including the most northerly portion terminating at John Day Dam, was energized in December. The second 500-kv AC Intertie line is scheduled for energization in May 1968. Work is under way on the first of the Intertie's two 750-kv DC lines, with the first line scheduled for energization in 1969. Contracts between participating Intertie utilities have been reviewed by Congress and executed.

CANADIAN TREATY

The first of the three Canadian Treaty storage projects, Duncan Lake Dam, was completed nine months ahead of schedule and became operational in July 1967.

Construction of Arrow Dam, scheduled for completion by April 1, 1969, will be ready for operation by December 15, 1968. Construction of Mica Dam, scheduled for completion by April 1, 1973, is on schedule. The United States is building Libby Dam in Montana under terms of the Treaty.

Initial reservoir-filling programs for the three Canadian projects have been agreed to by the Canadian and United States Entities.

HANFORD PROJECT

The world's largest nuclear power plant entered full, 800,000-kilowatt operations during fiscal 1967. Before being shut down by a labor dispute in the fall of 1967, the Hanford Project—operated by the Washington Public Power Supply System—fully proved its potential for helping to meet the critical Northwest power supply problem. Under the contractual arrangements governing operation of the project, Bonneville schedules the full output of the plant into the Federal system and in exchange delivers to the 76 participating utilities the amount of firm power, at Bonneville rates, equivalent to the annual costs of the generating plant.

APPEARANCE PROGRAM

Along with most other major electric power systems in the United States, Bonneville stresses appearance in planning new facilities, and is making a special effort to route overhead transmission lines where they will harmonize with the landscape. Substation structures

are designed for pleasing appearance and the sites are developed so as to be compatible with their surroundings. The inclusion of these appearance concepts in Bonneville's design criteria for new construction is estimated to cost one percent of the total program costs.

RELIABILITY

Because of rapid load growth in the Pacific Northwest, some Bonneville lines are heavily overloaded, and the integrity of the Bonneville system is in danger. As temporary measures, special load-shedding programs have been instituted to improve reliability. Completion of the facilities under construction and those included in Bonneville's fiscal 1969 budget request would enable the agency to achieve the level urgently recommended by the Federal Power Commission.

Since Bonneville is becoming increasingly interconnected with other systems, its reliability program is important to the whole of the Western United States. Conversely, of course, the planning and construction activities of utilities elsewhere in the West affect the reliability of the Bonneville system. That is why a new 12-state utility organization—the Western Systems Coordinating Council—has been formed to work toward the ultimate goal of a reliable and economical interregional power network.

The steps Bonneville is taking to apply the most modern computer techniques to its system—as an additional means of improving reliability—are described at some length elsewhere in this report.

IN CONCLUSION

I take pride in the solid start that was made in fiscal 1967 toward thermal-plant planning on a truly regional basis. I feel the necessary basis of understanding and communication has been established and that the time for firm commitments on thermal plants is fast approaching.

I take pride also in having headed, if but briefly, the capable and dedicated team of public servants that has developed over three decades at Bonneville.

And No. 1 on that team is Henry R. Richmond. His agreement to drop the "Acting" from his title assures Bonneville of outstanding leadership. Under his experienced and energetic guidance, Bonneville is certain to achieve new successes in serving the Nation and the Pacific Northwest.

Sincerely yours,

David S. Black

David S. Black
Under Secretary

December 31, 1967

Honorable Stewart L. Udall
Secretary of the Interior
Washington, D.C. 20240

Dear Mr. Secretary:

I assume the duties of Bonneville Power Administrator at a time when the Pacific Northwest utility industry is establishing new policies and patterns of operation that may endure for decades.

A number of significant factors, occurring more or less simultaneously, are responsible for the new era of sweeping change that is emerging. They include:

—Growing power demands.

—The development of nuclear generation on a scale unforeseen as recently as three or four years ago.

—Greatly strengthened interconnections between utility systems and regions; most importantly for our region, the Pacific Northwest-Pacific Southwest Intertie.

—Canadian Treaty storage.

—New power-system control techniques involving computers and other space-age instrumentation.

—A pressing need to meet higher standards of reliability.

—The economies of size, which require joint ownership of large generating plants.

—Greatly increased public interest in esthetic considerations and in preserving the natural environment.

20-YEAR PROGRAM

BPA's 20-year Advance Program, published in November, sets forth the magnitude and complexity of our challenge.

Pacific Northwest firm energy loads are expected to almost double from about 10 million average kilowatts in 1967-68 to more than 18 million kilowatts in 1977-78 and to almost 30 million kilowatts in 1986-87. The region's peak loads are expected to increase from about 15 million kilowatts in 1967-68 to more than 30 million kilowatts in 1977-78 and to 50 million kilowatts in 1986-87.

To meet this demand, the non-Federal utilities during the next two decades are expected to:

1. Construct and operate some 15 large thermal generating plants with a total capacity of about 15,400,000 kilowatts.

2. Add generation totaling nearly 5,000,000 kilowatts at non-Federal hydro plants.

3. Build nearly all of the new lower voltage transmission and a portion of the extra-high voltage system required by the region.

The Federal role would be to:

1. Add peaking capacity to existing Federal hydroelectric plants and build some additional multipurpose hydro projects at a total cost of some $4,400,000, including costs allocated to purposes other than power.

2. Supply surplus hydro energy.

3. Build most of the region's extra-high voltage transmission at an estimated cost of $2 billion.

4. Provide leadership in coordinated planning.

All in all, this would involve a total investment of $14,300,000,000, of which about $9,300,000,000 would be expended by non-Federal utilities and about $5 billion by the Federal government.

COOPERATION MANDATORY

The entry of thermal generation into the Northwest makes it mandatory that cooperative use of BPA's transmission be continuously expanded. Continued cooperation will result in economic and operational advantages which will help maintain the region's low power rate structure.

SYSTEM RELIABILITY

Our outlook on power reliability has undergone considerable change in recent years. We are no longer concerned exclusively with providing reliable service to the Northwest with its predominately hydro system. We now must concern ourselves with the effects of being interconnected with the less flexible thermal system to the south. While a system disturbance in the Northwest might have a small effect within the region, it could—because of a pyramiding effect— have much more severe consequences in neighboring areas. And the reverse could also be true, with the Northwest being affected by system disturbances elsewhere.

SALES TO INDUSTRY

Perhaps the most disturbing disclosure resulting from load-resource studies is the finding that on the basis of presently assured resources, BPA will be unable to meet fully the power requirements projected for the Northwest's electro process industries. It is estimated that the Northwest will have to turn away over the next 20 years, seven out of every ten potential new electroprocess industries due to an insufficiency of firm, low-cost power.

BPA's industrial sales program presently provides, directly and indirectly, jobs for some 39,000 Northwest residents. It adds a strong element of diversification to the Northwest industrial picture. Ways—not presently apparent—must be found to expand it.

LONG-RANGE GOALS

In addition to continuing to provide the region with an adequate low-cost power supply, improving service reliability and fostering interutility and interregional cooperation, our long-range objectives must include the maintaining of our fiscal responsibility by continuing to meet our repayment obligations on schedule, and making further improvement in the appearance of our transmission facilities.

Achievement of our goals requires a continuous refining and updating of our planning processes. The 20-Year Advance Program, for instance, must be revised and re-issued every year. Hopefully, this will help provide a basis for further close, cooperative planning on the

Joint Power Planning Council

part of the region's utilities, leading to the ultimate solution to the formidable power-supply problems facing the Pacific Northwest.

CONCLUSION

I approach the challenges ahead with enthusiasm and with the knowledge that I will have the help of an exceptionally able and dedicated staff.

I am convinced that with continued and increased public understanding of our program, success will be achieved.

Sincerely yours,

H. R. Richmond

H. R. Richmond
Administrator

A More Reliable System...

Electricity has become so commonplace that the consumer expects, and rightly so, to have it whenever he closes a switch. In former times an electric power failure imposed a temporary inconvenience. Today a power failure brings most normal activity to a halt, sometimes with crippling impact.

The reliability of service to all consumers in the Northwest, as well as to those served by utilities interconnected with the Bonneville Power Administration through ties between regions, is dependent on the integrity of the BPA system. As the wholesaler of bulk electric power in the Pacific Northwest, BPA operates 80 per cent of the region's high-voltage transmission capacity. Reliability is one of the chief concerns at Bonneville. It influences every decision as to how the system is designed, built, operated and maintained.

Reliability has come in for more than its usual share of attention at Bonneville during the past year. This was because of rapidly expanding loads, fiscal constraints, and problems with 500,000-volt equipment.

And then, too, the advent of the Pacific Northwest-Pacific Southwest Intertie and Columbia River Treaty projects is placing new responsibilities on BPA. Our grid is now a key link in a transmission network extending from British Columbia to the border with Mexico.

A year ago BPA proposed a long-range power system automation program. The specific goals of this program were presented to Congress in the fiscal 1968 budget. We are developing a system to perform scheduling and control activities with the use of modern high-speed digital computers.

The program envisions using computers to acquire, interpret and manage vast amounts of data, to schedule river flows and generation, and to control voltages and switching on the transmission system. It will also require the development of display techniques that will allow our dispatchers to scan system conditions. The dispatchers will be able to override control actions of the computers when human capabilities are needed to respond to data or to reasons not supplied through normal data entry channels.

BPA's accomplishments to date under the program include the following:

1—We have been using a small control system computer with peripheral equipment. We are testing it for acceptability. Initial programs have been written to process some of the data used in estimating and scheduling generation and also for a simplified method of testing the validity of telemetered data.

2—We have let a contract for computers and other equipment for Intertie substations. The computers will record high-speed events and will log, select and transmit data. They have some control capability.

3—Preliminary designs have been drawn up for an advanced power system control center to be built at J. D. Ross Substation near Vancouver, Washington.

4—We have planned the work and purchased the equipment needed to modernize some of our telemetering with solid-state gear. The equipment will be used in circuits which perform part of the critical task of controlling generation.

John Day Dam under construction

5—In cooperation with other Federal agencies, we are taking steps to improve 65 stations that measure hydro and meteorological conditions. They will transmit their data automatically via microwave beginning in the fall of 1968.

6—Bonneville also employed an aerospace firm to assist in developing new concepts for this advanced system control program.

Any program to maintain reliability, of course, is a continuing one. So BPA plans to add facilities to bring us in line with the intrasystem criteria set forth this past year by the Federal Power Commission.

Meanwhile, BPA also is taking part in a 12-state Western System Coordinating Council. The Council has addressed itself to such tasks as studying systems, developing standards, working out solutions to operating problems, and formulating long-range plans to meet the criteria set forth for interties between regions.

Primary goal of all this work is to make our system more reliable. It will also improve our operating techniques and permit us to transmit more electricity for every dollar spent.

The Bonneville transmission system is essentially a series of high-voltage, high-capacity lines and substations connecting Federal hydroelectric plants with loads in the region. These lines form a network or grid designed and built so that power can be shifted from one line to another in case of trouble. In other words, loads can be served from more than one source and no area will be cut off by the loss of one line.

BPA, which has hundreds of miles of line now under construction, soon will have 11,000 circuit miles in operation. About 4,000 miles will be supported by wood poles and more than 7,000 miles by steel towers. The engineers who put this system together were guided by their own technical skills and by the wise counsel of a number of older and more experienced electrical engineers who were attracted to BPA in its early years by the challenge of the Bonneville Project Act. They also have traded ideas continuously with other electrical and transmission engineers throughout the country and the world.

BPA's system was designed to equal or exceed the heavy load requirements of the National Electrical Safety Code. It specifies, for example, storm conditions under which one-half inch of solid ice forms on all conductors and assumes that a 57-mile-an-hour wind is blowing at right angles to the line. These "specs" also assume an unbalanced pull on the conductors. More ice and a greater unbalanced load are figured in for higher altitudes. Just to be sure nothing falls down, the structure design incorporates a safety factor of 150 percent.

Rarely do these conditions occur simultaneously on the BPA system. However, once in a great while they do and when this happens a tower or two may crumple under the strain. We have had occasions when 10 inches of "rime" ice formed on the lines. Fortunately, the wind had not risen at the time to 57 miles per hour. Were both conditions to occur at once, the line *should* fall down.

When we say "should fall down," we mean that if the line did not fall, it would be "overdesigned." Our engineers must assess local weather extremes, then design according to the applicable codes — and good judgment — to provide the best possible transmission lines with a reasonable investment in materials.

The economics in each situation becomes decisive. If a facility is "overbuilt," it becomes excessively expen-

sive. Over a number of projects and period of time, this could lead to higher power rates.

Our system so far has proved itself through the test of time. Our engineers do not claim that any particular unit is infallible, given rough enough circumstances, but they do claim that the degree of reliability on the system equals or exceeds that found anywhere in the world.

BPA in past years has set a number of new standards in transmission design. We were among the first to specify a lead sheath for standard control cables, eliminating virtually all insulation failures. Then we solved the problem of induced voltages in these cables by grounding the sheath solidly. We also enclosed each complete control circuit in a single sheath, further minimizing induced voltages.

BPA has adopted a "breaker and a half" scheme using three circuit breakers from each pair of 500,000-volt lines terminating at a substation. This makes a spare breaker available for each pair of lines and contributes in other ways to reliability.

Many of our major substations are located on railroad spurs so that large transformers may be replaced quickly with others brought in by rail. For the smaller substations, we use spares mounted on truck trailers. They are stored at strategic locations, ready to roll to trouble spots.

A sophisticated arrangement of protective devices has been built into every substation. In case of a fault, these devices automatically disconnect the faulted portion of the system in a fraction of a second.

Many faults last but briefly. For example, lightning striking a transmission line often may cause a current

to flash across the insulators. If the line trips out the arc created by the flashover is extinguished. After the line trips out, devices automatically re-energize the circuit. If the line then "stays in," service is restored so quickly that customers are scarcely aware of an interruption.

Bonneville dispatchers may order a load dropped to preserve the integrity of the system. But BPA also has set up its operations so that it can shed specific loads with automatic devices. These loads may be shed when the system frequency sags below 60 cycles per second, or they may be shed when transmission lines become overloaded during emergencies.

A load shedding program based on system frequencies has been used by BPA since the early 1950's. It has minimized the effect of major disturbances and speeded the restoration of service in many instances. The program is being revised now to meet higher standards. Relays will automatically drop portions of the loads at four frequency levels—59, 58.5, 58 and 57.5 cycles per second. More than 60 percent of the load dropped will consist of industrial loads, primarily aluminum potline load adapted to short outages.

Bonneville, in addition, uses a number of schemes to disconnect loads when the lines become overloaded. This helps to prevent a series of interruptions growing out of one incident. A cascading effect—with relays tripping out other facilities—could cause the outage to spread over a wide area during heavy load conditions. The necessity for most of these schemes will be eliminated by additional transmission lines that are either on the drawing board or under construction. The tripping schemes, in essence, are stopgap measures.

These and many other features of the BPA system contribute to reliability.

Computers & Reliability

Computers are not new to BPA. The first time one was used by our engineers was in 1938, the same year Congress created this agency. Several BPA engineers built a d.c. calculating board to study power system faults. The board was, in fact, an analog computer and with it they determined ahead of construction, ratings for circuit breakers and other equipment.

In 1942 BPA installed an a.c. network analyzer, another analog computer, to represent the power system in miniature. Engineers simulated load conditions, analyzing the mini-system's dynamic response to applied faults and changes in load and generation. The studies guided system design. As the system expanded, the analyzer grew. It is now the largest of its kind in the world.

BPA today uses other special analog computers to investigate harmonic filtering, switching surges and exciter control.

In 1955 power oriented BPA mathematicians, using a digital computer, solved a complex problem of power flow and achieved a breakthrough of international import. Two employees earned $5,000 in awards. Their approach is still used for load flow and stability studies which enable BPA to plan years in advance of actual construction. For example, digital computers helped prove that interconnection with systems in the Southwest and Midwest were technically feasible. These regional ties offer tremendous benefits — seasonal load diversity, the pooling of reserve generation, diversity of power sources, etc.

The first time BPA used a computer to control the power system was in 1962. We installed an analog device,

Computers at B P A

called a load frequency control computer, in the dispatching center. It automatically controls generators in five powerhouses at Federal dams on the Columbia River. The computer:

1. Matches generation with continuously changing loads of BPA customers.
2. Maintains prescheduled energy exchanges with utilities.
3. Holds system frequency within prescribed limits.

The computer performs its special tasks with superhuman speed and accuracy. Nevertheless, it gets some help from the dispatchers. They in turn are able to employ more efficiently the river's flow as it moves through dams between the headwaters and the sea.

As the power system becomes more extensive and interregional ties more common, system control grows in complexity. High speed protection systems are developed for larger lines and more severe disturbances. A disturbance in one region must be dealt with in accordance with the effect on other regions. Newer, more intricate, puzzles present themselves. BPA finds itself in a situation not unlike that of the medical profession which may painstakingly cure one affliction only to have another serious disease appear.

The complexities of power systems are outstripping man's ability to respond within tolerable time limits — to solve scheduling problems, react to alarms, and observe trends. To adapt, man is turning to computers, and fortunately computers are improving. The newer ones handle more information and a greater variety of work at faster speeds.

With modern society demanding new levels of reliability, a high speed system-wide control system directed by a computer appears to be necessary. The control

system must quickly sense impending trouble and take corrective action to hold the power system together and keep power flowing to homes and industry.

Man will still make basic decisions, often planning them in advance. The decisions will be placed in memory banks of computers and retrieved when certain conditions occur. The computers will also assist with high speed computations. Information will be fed instantly to display devices where it can be viewed by dispatchers.

In an effort to develop such a computer-directed control system BPA initiated a study early in 1965. The Northeast blackout occurred later that year. It added an element of urgency.

Preliminary findings indicated that the control concept could take on many functions necessary to reliable service during emergencies. The study also showed the scope of tasks to be performed on a power system will challenge the capability of the "smartest" computers on the market.

The job of developing this advance control system required technical help. BPA looked to the aerospace industry because of that industry's experience in solving difficult control problems.

We engaged North American Rockwell Corporation. After examining operations at BPA, one of the firm's experts commented that the concept of controlling BPA's system with computers presents a scientific challenge as formidable as the Apollo program, which will send astronauts to the moon.

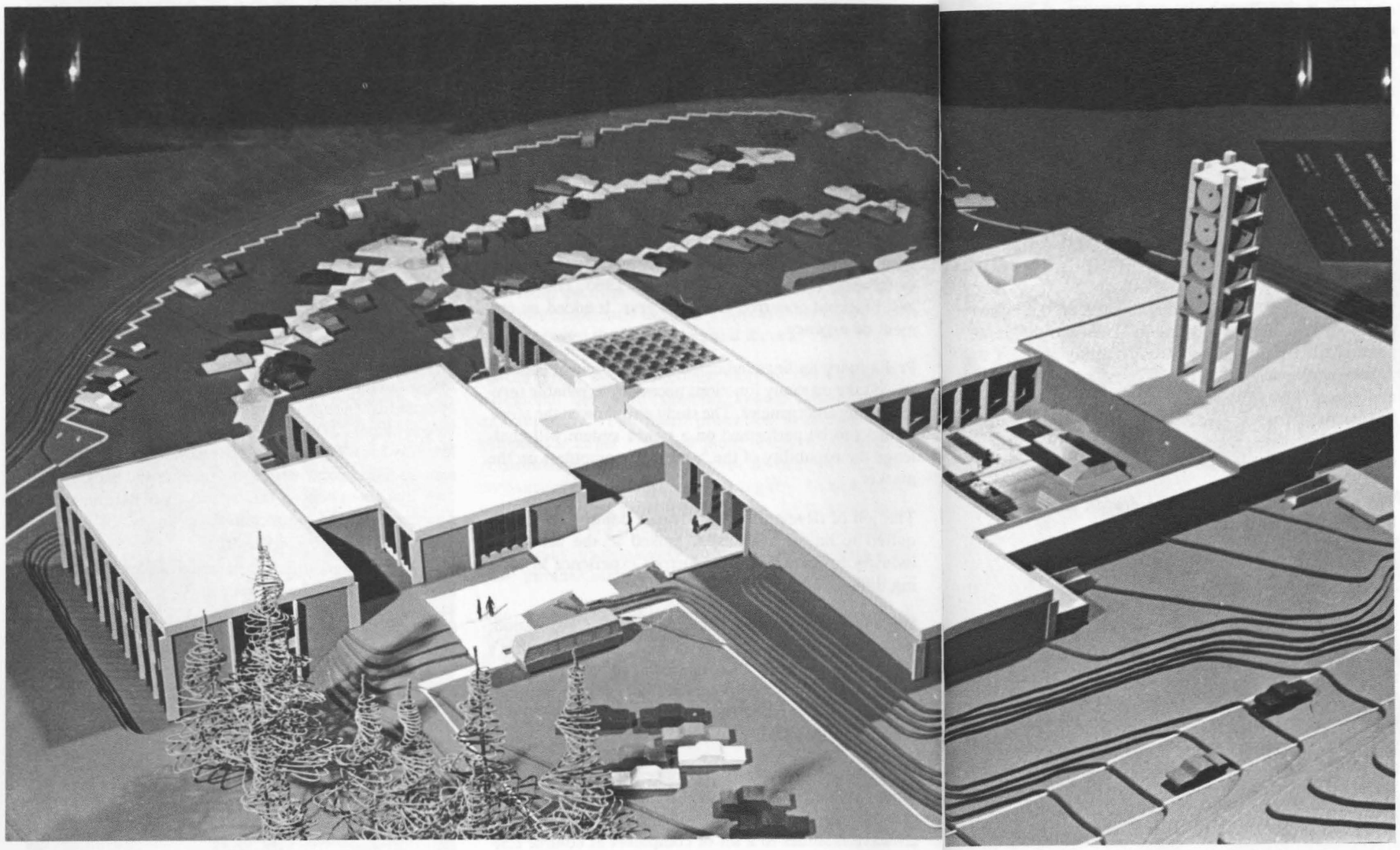
BPA and NAR presently are concentrating on developing a fast, reliable data acquisition, transmission, and management systems. Data will travel over BPA's microwave facilities to a set of computers at control centers. The computers will process vast amounts of power measurements from substations and powerhouses, as well as data from weather stations and interconnected utilities. Commands from the computer will go via microwave to switches and regulators that operate high voltage transmission equipment.

Information may be gathered with a combination of techniques, including conventional methods as we know them today. Some information needed to operate a large hydroelectric system, such as weather data and water levels, does not require split second sensing. But other information, required for system stability and protection, must be relayed instantaneously.

It was once suggested that BPA might want to use a communications satellite. However, BPA is discovering that a satellite communications system will not always operate fast enough. A synchronous satellite would orbit our planet 22,000 miles above its surface. This is too far away for BPA's purposes. Even at the speed of light, a message sent from earth to the satellite and back would take five times longer for its trip than the minimum time required for some control actions.

BPA and several other Federal agencies are investigating a joint data gathering system.

Out of all this study and work BPA hopes to get one of the world's most advanced and reliable power systems.



Coming:
An Improved Control Center

The preliminary design for a new system control center at the J. D. Ross Substation near Vancouver, Washington, was prepared in 1967. The design was integrated with a master plan to rearrange and reconstruct most other facilities at the substation.

The center will contain central units for BPA's advanced power system control and dispatch. The design calls for a building with about 168,000 square feet of floor space. It will house the power dispatching center, a central computer complex, power system control circuits and terminals, a supervisory (remote) control center for substations in the Portland area, a substation operators training center, a viewing room for visitors, and office space for support activities.

BPA has no intention of moving any headquarters functions from the Bonneville building in Portland.

More than half of the floor space in the system control building at Ross will be underground to assure continuous operation of the control center by protecting its occupants and equipment against storms, earthquakes, fallout, or other hazards.

The total cost of the new center at Ross is estimated at about $5 million.

Final designs are to be completed by October 1968. Construction will begin, under the current schedule, in March 1969. The building is to be ready for the installation of equipment in April 1970, although the structure itself will not be completely finished until that October. The target date for putting the center into operation is July 1971.

Until then BPA will continue to operate system control from the Portland building. The present control center already has outgrown the space available in the headquarters building. It has been quartered there since 1954. Prior to 1954 it was located at Ross.

The advanced control center to be built at Ross is an extremely complex undertaking, one which will require extensive modifications in the present system. The equipment will demand precise environmental controls. Computers, for example, are especially sensitive to temperatures and humidity, both of which must be kept within narrow limits.

Once the system begins to operate, it must continue to do so round the clock, day after day, year after year. This, together with the computers' sensitivity to dust and vibration, would make any attempt to expand the building later rather infeasible. Thus, the preliminary design for the building provides space within the structure for expansion.

We expect about 90 persons to work in the building when it is first occupied. The staff will gradually expand to about 300 persons.

The master plan for Ross, of which the control center is a part, will attempt to bring order out of 20 years of chaotic growth. That growth has expanded fivefold in the past eight years.

During a period of about three decades, Ross has developed into a central point of warehousing, laboratories, shops, maintenance, and construction. A conglomeration of buildings and yards has spread over the site. Today the buildings contain technical and high voltage laboratories, paint shops, metal and carpenter shops, equipment storage and other activities. The yards around the buildings store spare parts, equipment, construction materials, vehicles and supplies. A modern, efficient warehouse has been built.

However, because of the vagaries of rapid growth, some activities are scattered among different locations. Traffic is congested and slow. Some of the buildings functioned poorly. Needs have changed. The laboratories have expanded and are using space originally intended for storage or for repair shops. The warehouse operation has been seeking more and more space for outdoor storage. As a result, many of the activities at Ross are finding it increasingly difficult to operate efficiently.

During 1967 BPA put the final touches on the master plan to restructure the physical facilities and the traffic pattern. Each operation at Ross carefully assessed its future requirements in terms of workload, personnel, and space. This information was given to a Portland architectural firm, Stanton, Boles, Maguire and Church. The firm developed the master plan for Ross, as well as the preliminary design for the control center.

The plan will accommodate the growth anticipated at Ross for 20 years to come.

Progress on the Intertie

This past fall BPA completed the northern section of the first 500,000-volt line for the Pacific Northwest-Pacific Southwest Intertie. It runs south from John Day Dam 89 miles to Grizzly Substation near Madras, Oregon. There it connects with a section of the line completed earlier in the year, BPA's 184-mile line to Malin Substation on the Oregon-California border.

Thus, the first transmission line of the Intertie stands

450

complete across Oregon. It links BPA's main grid with similar facilities in California.

The line is the first of four big Intertie lines. It already has begun to serve as a sort of electrical freeway between the two regions. Ultimately, the Intertie will benefit utilities and their customers all the way from British Columbia to the Mexican border.

Pacific Power & Light Company has constructed a 47-mile section of line south from Malin, which, in turn, hooks up with Pacific Gas and Electric Company's line through California.

The Intertie is a cooperative project of four private utilities, two Department of the Interior agencies, and the City of Los Angeles. It is the largest single transmission program ever undertaken in the United States.

Malin Substation typifies the joint effort. It is a $3.1 million facility built by BPA, PP&L, and Portland General Electric Company. BPA supervised the actual construction and put up 49.7 percent of the cost. PP&L's share of the cost is 26.5 percent and PGE's 23.8 percent.

When complete, the Intertie will represent an investment of $660 million with $273 million coming from private utilities, $298 million from the Federal government, and $89 million from the City of Los Angeles. BPA's share of the Federal cost is $167 million and the Bureau of Reclamation's $131 million.

In the next 50 years the Intertie will return benefits estimated at $2.6 billion.

The four major lines of the Intertie will be able to carry more than 4.5 million kilowatts north or south and will tie together utilities in 12 states.

The Northwest and Southwest were tied together temporarily in November 1966. PP&L's 47-mile section south of Malin operated at 230,000 volts. Between 200,000 and 300,000 kilowatts from Southwest steam plants flowed north to help serve interruptible loads and prevent layoffs at aluminum plants. Low water conditions had forced BPA to cut off deliveries of interruptible power.

The initial connection between the Northwest and Southwest at 500,000 volts was made at 11:56 a.m., September 20, 1967. The circuit remained closed for several hours but no load was scheduled either way over the line. Both northern California and the Northwest had more water at that time than was needed to generate electricity within each region. The initial 500,000-volt connection originated from PGE's Round Butte Dam in central Oregon. A 16-mile, 500-kv line from the dam, Grizzly and Malin substations and the line between the two substations were energized.

Portland General is constructing a second 500-kv line parallel to the first from Grizzly to Malin. BPA is building the northern leg from John Day Dam to Grizzly. The second line across Oregon is to be ready for service in May 1968.

The first two Intertie lines will operate with alternating current. The two other major lines will be 750,000-volt direct current lines.

BPA is building the Celilo Converter Station near The Dalles, Oregon, where alternating current will be converted to direct current and sent south. When power flows north on the two d.c. lines, terminals at Celilo will

convert the flow to alternating current and feed it into the BPA grid.

BPA began constructing Celilo in the fall of 1966. During the spring and summer of 1967 basement walls and floors of the building took shape. By fall the steel frame of the building loomed above the site. The building will be three stories high, 126 feet wide and, when both wings are finished, 790 feet long. Each wing will house a terminal for one of the Intertie's d.c. lines.

Construction of the switchyard at Celilo will start in 1968.

The first d.c. line will run from The Dalles to Los Angeles where the City is building a terminal to match the one at Celilo. Although these terminals will not be finished, the schedule calls for the first d.c. line to be operated at half capacity for three months beginning in April 1969. During these months Northwest streams will be running brimful, and the region will use the line to market power surplus to its needs. The line will then be shut down, the terminals completed, and the line readied for full operation in December 1969.

BPA is erecting 466 aluminum and 70 steel towers on a 114-mile stretch of the line. The purpose in using aluminum towers is to compare their cost and performance with steel towers. Designed and manufactured by Kaiser, the aluminum towers average 120 feet in height. They have a single mast and are held up by guy wires.

The second d.c. line will go from Celilo to Hoover Dam. The line is to be completed in September 1971, and the terminals by January 1972. The right of way has been obtained. Designs are finished. But no construction has been started.

Malin Substation

Diversion tunnels at Mica damsite

Treaty Projects

One of the four projects made possible by the Columbia River Treaty has been completed, and the other three are under construction.

On July 31, 1967, Canada notified the United States that Duncan Dam was operational. Duncan was completed nine months ahead of schedule. Until the terms of the Treaty on Duncan take effect March 31, 1968, the added generation made possible with Duncan storage is being divided equally by the two countries. The United States has been delivering Canada's share, an average of 95,000 kilowatts, to British Columbia Hydro and Power Authority.

Duncan is an earthfill dam located at the outlet of Duncan Lake on the Duncan River in southeastern British Columbia. The dam is about half a mile long and 120 feet high. Water released from Duncan increases the dependable capacity of U.S. hydroelectric plants downstream.

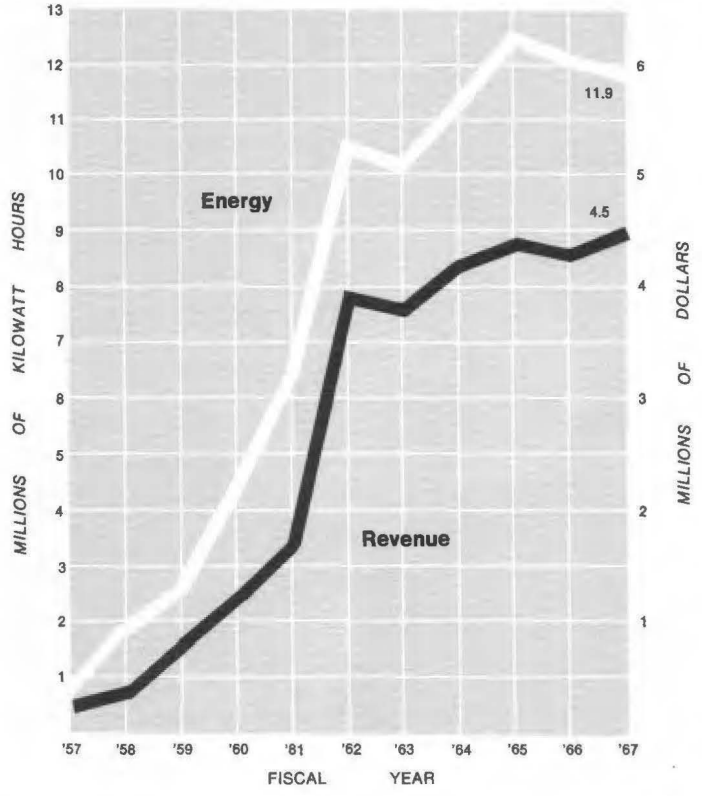
Capping the Columbia

The construction of Arrow Dam is on schedule. It is to be finished by April 1, 1969. Arrow is five miles above Castlegar, B.C., on the Columbia River.

Last fall Canada let the main construction contract on Mica Dam deep in the interior of British Columbia where the Columbia, sweeping across rapids and booming through deep canyons, makes a big bend and turns south toward the United States. Mica is to be completed in 1973.

Mica is in the earlier stages of construction. Two diversion tunnels, each 45 feet in diameter, have been bored through 3,000 feet of rock. The tunnels can carry about

BPA WHEELING REVENUE 10 Years—1957-1967



a million gallons of water per second. Mica will be a large earth and rockfill project rising 645 feet above the river bed.

The three Canadian dams will store 15.5 million acre feet of water, which about doubles the storage capacity on the Columbia River and its tributaries. Water released from the Canadian projects will increase the dependable capacity at 11 U.S. dams downstream by 2.8 million kilowatts. They will level out the flow of the Columbia River The United States and Canada are dividing equally the added power that can be generated, and Canada has sold her share for 30 years to purchasers in the United States.

The United States is building Libby Dam on the Kootenai River in Montana. Libby will store another 5 million acre feet and make it possible to generate 750,000 kilowatts at site and downstream in the United States. The Treaty permitted the United States to build Libby which will back water 42 miles into Canada. The dam is scheduled to begin generating electricity in July 1973.

The four Treaty projects will all but end disastrous flooding on the Columbia. They will make it possible to control a flood as great as any in recorded history.

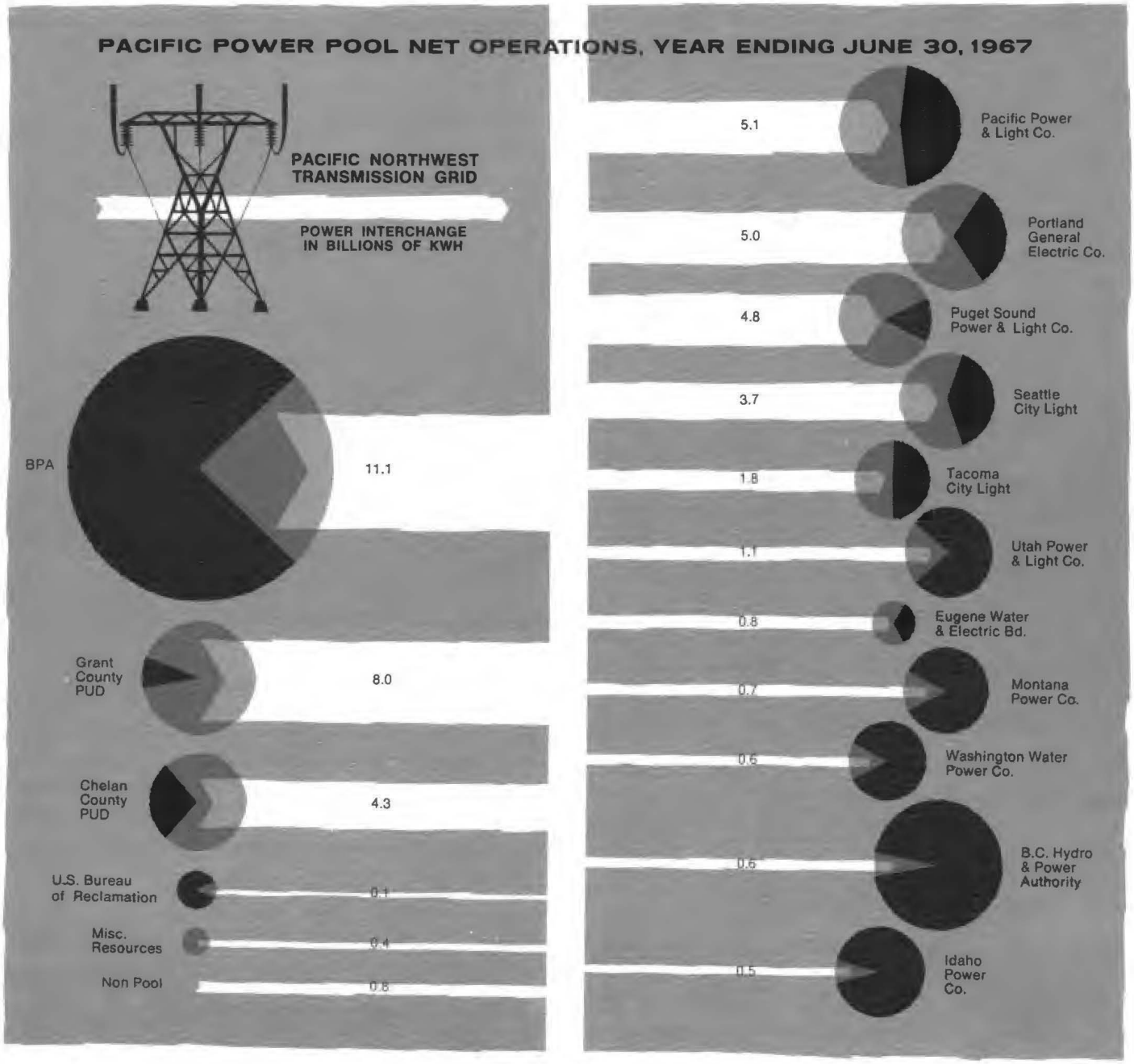
Generation

The Pacific Northwest currently has 15,374,332 kilowatts of generating capacity installed in Federal and nonfederal projects.

The number of Federal dams producing electricity was raised to 22 in June 1967 when the Corps of Engineers completed Green Peter on the Middle Santiam River in western Oregon. The capacity installed at these projects is 6,758,150 kilowatts.

Nonfederal generating plants in the region have a total capacity of 8,616,182 kilowatts. Included in this amount are 800,000 kilowatts of the Hanford Nuclear Generating Plant and 449,954 kilowatts for old steam plants.

Eight Federal dams are being built. They have a total nameplate rating of 8,552,000 kilowatts. They are Foster, John Day (16 units), Lower Monumental, Little Goose, Lower Granite, Dworshak, Lost Creek, and Libby.


PACIFIC POWER POOL NET OPERATIONS, YEAR ENDING JUNE 30, 1967
PACIFIC NORTHWEST TRANSMISSION GRID
POWER INTERCHANGE IN BILLIONS OF KWH
BPA
11.1
Grant County PUD
8.0
Chelan County PUD
4.3
U.S. Bureau of Reclamation
0.1
Misc. Resources
0.4
Non Pool
0.6
5.1
Pacific Power & Light Co.
5.0
Portland General Electric Co.
4.8
Puget Sound Power & Light Co.
3.7
Seattle City Light
1.8
Tacoma City Light
1.1
Utah Power & Light Co.
0.8
Eugene Water & Electric Bd.
0.7
Montana Power Co.
0.6
Washington Water Power Co.
0.6
B.C. Hydro & Power Authority
0.5
Idaho Power Co.

Additional generators to be added at The Dalles Dam and Grand Coulee Dam will have a capacity of 4,288,000 kilowatts. This figure includes 3,600,000 for the Third Powerhouse, which is in the initial phase of construction at Grand Coulee.

Congress authorized the Third Powerhouse June 14, 1967. Subject to further Congressional authorization, the size of the turbine-generators in the powerhouse may be increased and its capacity raised to 7.2 million kilowatts. Grand Coulee then would have a capacity of more than 9 million kilowatts.

Nonfederal utilities plan to add 2,655,850 kilowatts at projects that are under construction or licensed.

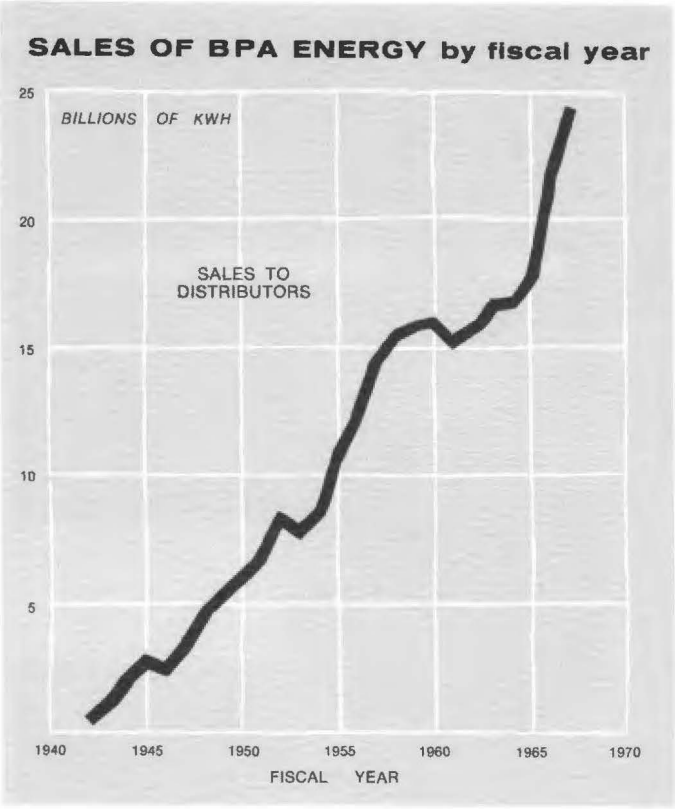
These figures do not include any capacity for High Mountain Sheep Dam. The United States Supreme Court in June 1967 set aside a Federal Power Commission license granted to Pacific Northwest Power Company to build the dam and remanded the case to the FPC for further proceedings.

The figures also do not include 39,082 kilowatts of capacity at isolated Federal projects which do not produce power for commercial sales. They are operated by the Navy, Bureau of Reclamation, National Park Service, and Bureau of Indian Affairs.

BPA estimates that Northwest electric power requirements will triple in the next 20 years.

The region is running out of feasible hydro sites, although a few remain which can be developed. Turbine-generators may be added at other projects.

After 1974, the Northwest will require steam plants to meet the base load at the rate of one plant a year with a capacity of more than 1 million kilowatts. The U.S. Columbia River Power System will support these steam plants with peaking capacity, reserves, and transmission capacity over BPA's grid.

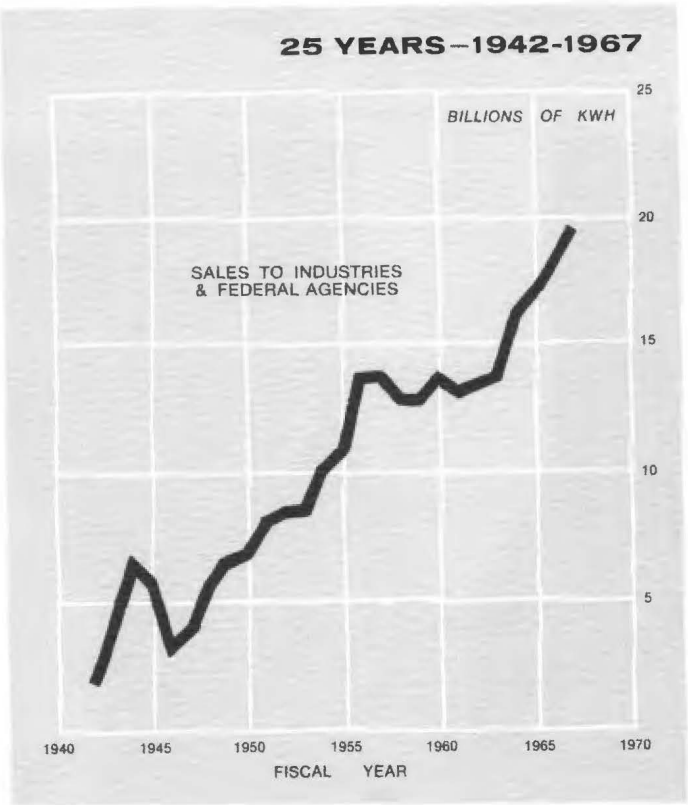


Congress has authorized additional hydro projects with a total capacity of 1,687,000 kilowatts. This figure includes Asotin Dam on the Snake River, Teton Dam on the Teton River, and additional generation at Chief Joseph, Ice Harbor, and Bonneville dams, and a pump-turbine project at Grand Coulee.

Sales & Revenues

Bonneville Power Administration sold 44 billion kilowatt-hours of energy in fiscal 1967.

BPA revenues increased 9.7 percent over fiscal 1966



and totaled $110,164,000. Revenues from generating projects raised the system total to $112,828,000.

Sales revenues again reached a new high, $104,465,000. Revenues from sources other than sales — mainly wheeling, coordination, and headwater benefits — totaled $5,699,000.

The amount of energy sold rose 11 percent during the year, and revenues from sales 9.9 percent.

Approximately 42 percent of the total energy sold went to publicly owned utilities. They numbered 104.

Thirteen percent of the energy was sold to eight private utilities, 34 percent to aluminum plants, and 10 percent to other industries and Federal agencies.

Power sales brought an average of 2.38 mills per kilowatt-hour.

Among the publicly owned utilities, the largest purchasers were Seattle City Light and Snohomish County Public Utility District who bought 3.1 and 2 billion kilowatt-hours, respectively.

Pacific Power and Light Company led the private utilities with purchases of 2.5 billion kilowatt-hours.

The biggest single purchaser was Kaiser Aluminum and Chemical Corporation with 4.4 billion kilowatt-hours. Reynolds Metals Company was second among the industries with 2.7 billion kilowatt-hours, and the Aluminum Company of America third with 2.6 billion kilowatt-hours.

Hanna Nickel Smelting Company bought 726 million kilowatt-hours and led the industrial customers other than aluminum.

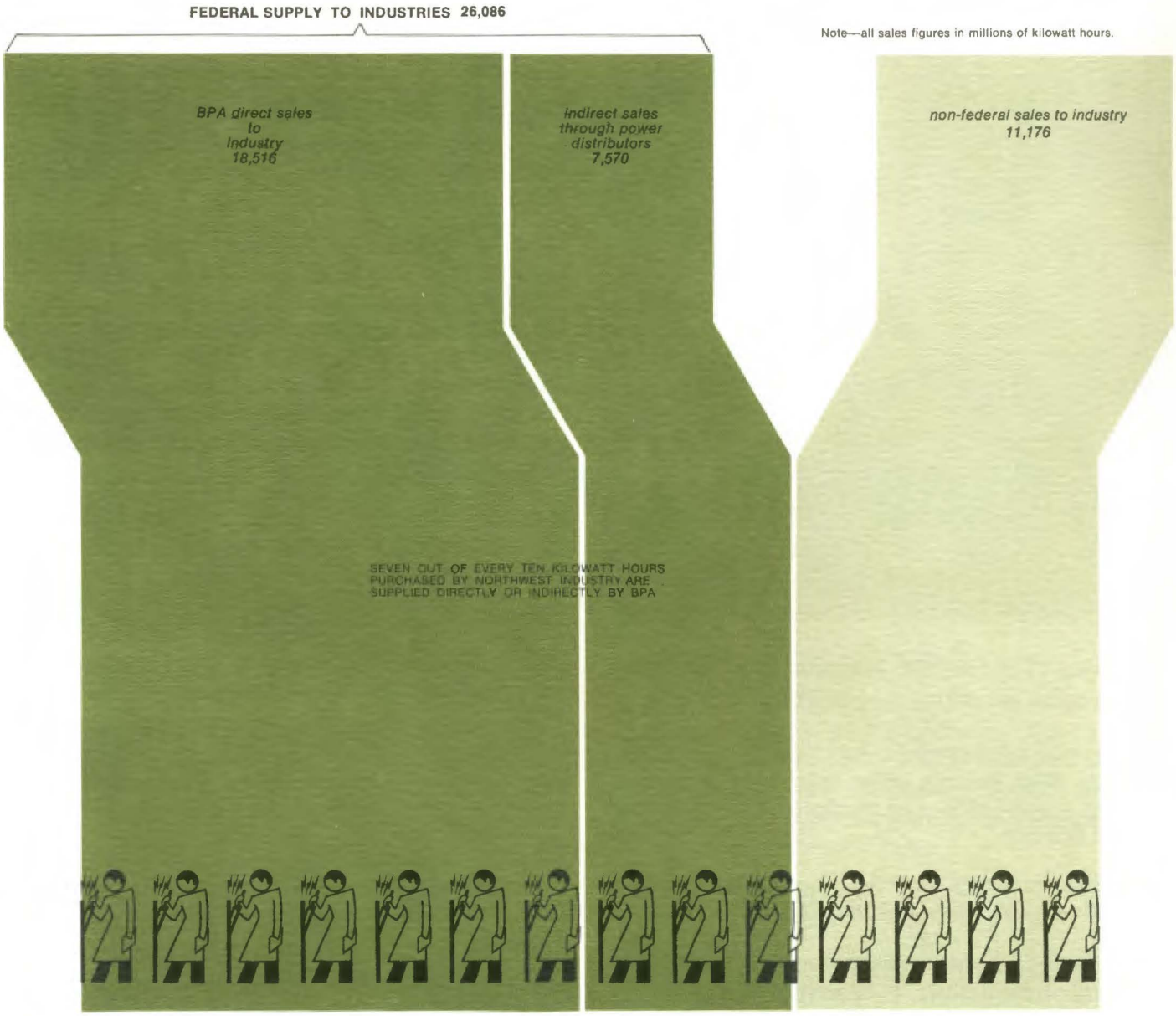
Firm energy sales increased 44 percent, and nonfirm energy sales 14 percent.

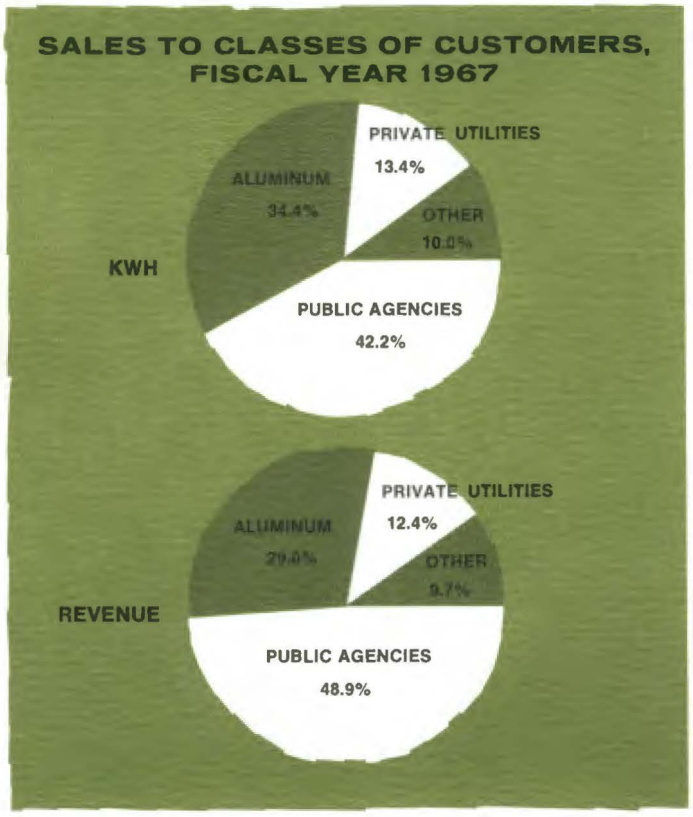
The aluminum and other industries purchased 19 percent more firm power, but decreased their interruptible purchases 8 percent. Publicly owned utility purchases were up 6 percent, private utility purchases 42 percent.

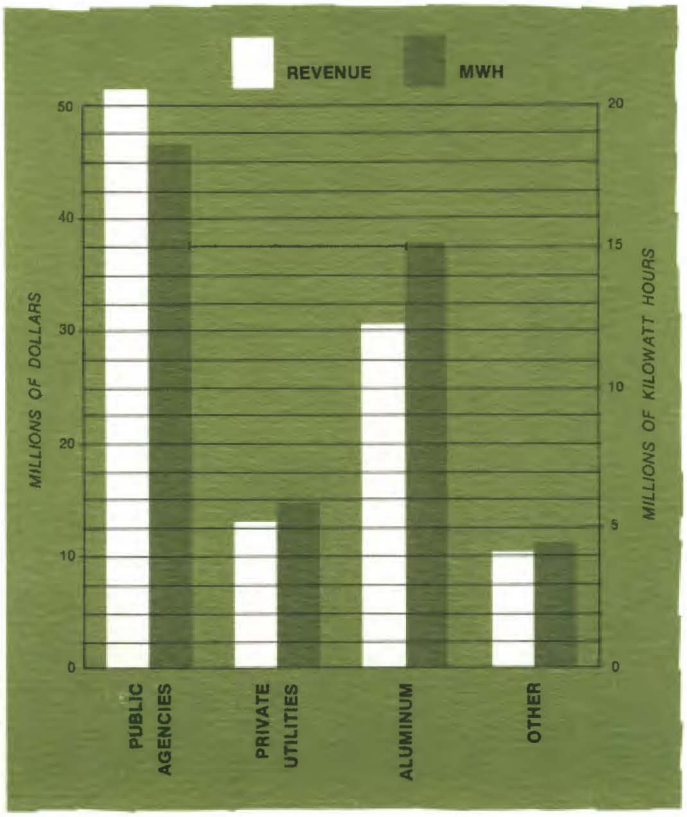
By class of customer, sales ranged from an average of 2.03 mills for industries (including at-site deliveries) to 2.2 mills for privately owned utilities and 2.76 for publicly owned utilities.

As a general rule, it costs less to supply power to a purchaser who buys a high load factor. BPA's industrial customers buy at nearly 100 percent load factor, and,

SOURCE OF POWER FOR PACIFIC NORTHWEST INDUSTRIES FISCAL YEAR 1967







therefore, their average cost of energy is the lowest of any class of customer.

The load factor is the ratio of the average load over a designated period, such as a month, to the peak load occurring in that period.

The private utilities also purchase power from BPA at a high load factor. They use large amounts of their own generation to meet their peak loads. This results in a low cost to them as a class for the energy they purchase from BPA.

Many of the public utilities buy all of their power, including peak needs, from BPA. This results in a slightly higher than average cost of energy, as compared with the industrial and private purchasers.

Building for Tomorrow

Bonneville Power Administration's construction program started in 1938. By 1941 when Grand Coulee Dam came on the line BPA had shattered all records by building 1,063 miles of line. More than half were for 230,000-volt circuits.

The region's growing demand for electricity has sustained this building pace for 30 years. Today BPA operates the world's largest network of long distance high voltage lines — 10,478.7 circuit miles.
During calendar year 1967 BPA completed a total of 630 circuit miles.

The emphasis in the present construction program is on a 500,000-volt grid to overlay the existing 230,000-volt grid and give the Northwest the increase in transmission capacity it must have to assure an adequate, reliable flow of power.

As of December 31, 1967, BPA had completed 835 miles of 500-kv lines, six new 500-kv substations and four 500-kv series compensation stations. The 835-mile figure includes 562 miles for the main grid and 273 miles for the Pacific Intertie. Four of the substations are on the grid, two on the Intertie.

During 1968 BPA plans to energize another 767 miles of line, much of which will be 500-kv. And before 1968 ends, BPA will have nearly finished 265 miles of the first 750,000-volt direct current line for the Intertie. Before another ten years pass, BPA will have about 3,000 miles of 500,000-volt lines in operation at a cost approaching half a billion dollars.

Part of the grid will be a 675-mile closed loop which is to be ready in 1970. A 500-kv spur will connect the grid with British Columbia Hydro, as required by the Columbia River Treaty. New 500-kv lines will strengthen transmission to fast-growing, diversified loads in western Oregon.

Later, part of the 500-kv grid will be extended into Montana and also up the Snake River to integrate dams being built on the Lower Snake and the Clearwater River.

Months of investigation went into the decision to construct the 500,000-volt overlay grid. The question necessarily posed now to system design, which must work years ahead of the time lines are actually built, is whether to go to a still higher voltage.

Transmission lines have been getting bigger. One reason for this, of course, is the steady growth in electrical loads. Another has been to achieve what engineers call "economies of scale." As the technology of transmission advanced, the engineers built lines that carried greater amounts of power at higher voltages. The cost per kilowatt of transmitting the power is the same, or slightly less, today as compared with costs 30 years ago, although material and labor costs have spiraled upwards.

Still another reason for bigger lines is competing land uses. The larger lines require less land per kilowatt of capacity for rights of way. For example, four 230-kv lines each requiring a right of way 125 feet wide can move a million kilowatts of electricity. A single 500-kv line can move the same amount of power over a right of way 150 feet wide.

Thus the higher voltages and larger capacity lines conserve land for recreation, timber, agriculture, and housing developments. Land conservation had an important bearing on the decision on construct the 500-kv grid. Looking into the future, we see land becoming increasingly important. Transmission lines are likely to get even larger, and in some places they may go underground, despite the greater cost of burying cables.

The electric industry currently is pushing research in both a.c. and d.c. transmission over lines of more than 1 million volts. BPA is taking an important part and sharing the cost in a research program sponsored by Edison

Electric Institute. BPA is obligated to spend about $800,000 as a participant with private companies in Project UHV (ultra-high voltage). The research program is to be completed in 1971.

One reason for the program is that present techniques apparently will have to be modified substantially before voltages higher than 750-kv can be considered.

There are some developments looming in the future that may dictate the use of these larger lines. Steam plants with a capacity of at least 1 million kilowatts each will come into production in the Northwest at the rate of one a year beginning about 1975. The key to reliability is adequate transmission. As the region's prime mover of bulk power, BPA must have enough transmission capacity to serve loads if one or more of the big plants shut down unexpectedly.

Also impending is construction of the Third Powerhouse at Grand Coulee. This powerhouse is likely to put 3,600,000 more kilowatts on the line by 1973. Most of this power will be transmitted to the Seattle and Portland areas over lines that are as yet unbuilt. Ultimately, Grand Coulee's capacity may exceed 9,000,000. kilowatts.

We face two alternatives. We can build 500,000-volt lines, or we can build a lesser number of higher voltage lines — 750-kv and above. A decision cannot be deferred too much longer.

The decision will involve such factors as engineering, operations, economics, reliability, right of way requirements, etc. But basically it involves a comparison. We must weigh the risk of moving a great concentration of power over a single ultra-high voltage line against the lesser risk but greater cost of moving the power over several smaller 500-kv lines.

Revenue Report

Annual revenues for the Columbia River Federal Power System reached another all-time high in fiscal 1967. The total of $112,828,000 topped last year's revenues by 9.4 percent. Sales to our privately owned utility customers were up 37.7 percent, the largest percentage increase in the major customer categories. Sales to the aluminum industry for the first time exceeded 30 million dollars. The increase, $4,078,000, was 15.5 percent over the previous year, the largest dollar gain in the major customer categories. A strong market for aluminum bolstered industry in the Pacific Northwest.

Streamflows were down almost to critical levels in the first part of the year, but improved considerably in the later months. The water conditions were about average for the year as a whole and did not adversely affect revenue.

Revenues from the very beginning of BPA operations in 1938 through June 30, 1967, have totaled $1,367,110,000. The biggest part of that went for interest, which totaled $468,383,000. Operation and maintenance costs totaled $404,375,000. The balance, $494,352,000, was applied to the repayment of the investment in the Columbia River Federal Power System.

The repayment figure is especially significant, for it indicates that more than 36 percent of every dollar we received went to repay the principal of our debt.

"Mortgage payments," the combined principal and interest payments since the beginning of operations, have amounted to over 70 percent of our total revenues.

Our repayment results have taken on added significance since the passage in June 1966 of P.L. 89-448

which authorized construction of the Third Powerplant at Grand Coulee. This bill contained a requirement for a consolidated annual report to Congress on the Columbia River Federal Power System. The legislative history of the bill dictates that the report should be on the repayment basis. This basis requires that wholesale power rates be set at a level which will repay the investment in each generating project within 50 years after it is placed in service, repay the irrigation assistance when it is due, and repay the investment in the transmission system over a reasonable period of years. The average depreciation life, 45 years, is used as the repayment period for transmission system investment.

Table 7—Repayment Study has been included to show the expected system repayment results for the future for all authorized projects in the system. The repayment study is based upon the cost estimates for the generating projects and the transmission system in accordance with the latest generation schedule. The study shows that the unamortized investment in the power system is below the allowable unamortized investment for each year of the entire repayment period. Hence, the study indicates that our wholesale power rate level continues to be adequate to meet the payout requirements.

Table 6—Operating Results on the Repayment Basis compares operating results for fiscal 1967 with fiscal 1966. The table shows that total system revenues are up 9.4 percent, as discussed earlier, and shows the detail by class of customer. Additional details of the revenue trends by class of customer for the past 10 years are shown on Table 8.

Interest expense is up only one-tenth of one percent, but system operation and maintenance expenses are up 33.8 percent. One new item accounts for the major part of this increase. The Hanford steam-plant was certified as ready for normal continuous operation on November 29, 1966, and the initial operating budget was adopted as of September 1, 1966. Under the terms of the exchange agreements, BPA schedules the full output of the plant into the Federal system, and in exchange, delivers to the 76 participants the amount of firm power, at BPA rates, equivalent to their respective share of the operating budget. The amount credited on the participants' power bills was $7,850,000 in fiscal 1967, and this amount is recorded as an expense for exchange power.

Excluding this new item, operation and maintenance expenses are up 6.6 percent over last year, principally for expanding operation and maintenance costs at BPA due to the rapid growth of the transmission system. O&M costs at the generating projects are quite stable from year to year but they will increase as additional projects are brought into service. The Green Peter-Foster project, placed in service in June 1967, added about $6,000 to system operating costs for the year. Separate financial statements for the Columbia River Federal Power System are prepared on the cost accounting basis, which includes depreciation expense on the compound interest method as one of the elements of cost. The cost accounting financial statements are audited by the General Accounting Office, and they are included as an addendum to this report, starting after page 37.

Construction Underway

HANFORD-JOHN DAY: 97 miles, 500-kv from Hanford to John Day Substation. This line will increase transmission capacity from Vantage, Hanford, and the Lower Snake plants to western Oregon. Energization date: October 1968.

KEELER-ALLSTON: 43 miles, 500-kv from Keeler Substation to Allston Substation located in Oregon across the Columbia River from Longview, Washington. This is the first link of a tie between Puget Sound Area and Portland. Initially, it will provide capacity to serve increased loads along the Lower Columbia River. Land acquisition is in progress. Major material is being ordered. Energization date: October 1969.

PAUL-ALLSTON: 65 miles, 500-kv from Paul Substation near Centralia, Washington, to the Allston Substation. This is the second link in the tie between Puget Sound and Portland. Energization date: October 1970.

PAUL-OLYMPIA: 9 miles, 500-kv from Paul Substation to Olympia Substation. The Olympia terminus will provide capacity to serve new loads in the Olympia and Tacoma areas as well as on the Olympic Pennsula. Energization date: October 1971.

RAVER-PAUL: 47 miles, 500-kv from Raver Substation to Paul Substation. This line with the Paul-Allston line will complete the Puget Sound-Portland tie and provide a high degree of reliability for transmountain lines into both areas. Energization date: October 1970.

SICKLER-RAVER-COVINGTON: 127 miles, 500-kv from Sickler Substation near Rocky Reach Dam to Raver Substation southeast of Seattle, then west to Covington Substation near Kent. This will integrate generation from Douglas County PUD's Wells Dam into the BPA system and add capacity to serve new loads in northwestern Washington. Energization date: October 1968.

Intertie construction

RAVER-MONROE-CUSTER: 65 miles, 500-kv from Raver Substation to Arlington, Washington. An initial 70-mile section to the north of this line was completed between Arlington and Blain and energized at 230 kv August 20, 1965. When the new 65-mile section is completed, the two line sections together with substation facilities will strengthen the BPA grid in northwest Washington and provide for Canadian interchanges with B.C. Hydro at Blaine. Energization date: October 1968.

OREGON CITY-MARION: 42 miles, 500-kv from Oregon City Substation to Marion Substation near Santiam, Oregon. Increasing load growth in the Willamette Valley will be served by this line. It will be strongly tied to the main gird at Oregon City. Energization date: October 1968.

MARION-ALVEY: 67 miles, 500-kv from Marion Substation to Alvey Substation near Eugene, Oregon. As an extension of the Oregon City-Marion line, it will provide main grid 500-kv service to the southern Willamette Valley to serve new load. Energization date: October 1968.

JOHN DAY-MARION: 129 miles, 500-kv from John Day Substation to Marion Substation. This line will complete the 500-kv loop from the main grid into Marion Substation providing alternate East-West transmission into the Willamette Valley. Energization date: October 1969.

MARION-LANE: 72 miles, 500-kv from Marion Substation to Lane Substation near Eugene, Oregon. With the Marion-Alvey line, this line will provide the second 500-kv line to Eugene. Energization will be scheduled somewhat later than the first line, depending on load growth in the area. Tentative energization date: October 1970.

OSTRANDER-HARRIS: 9 miles, 500-kv from Ostrander Substation to Harris Substation near Oregon City, Oregon. A new loop to the existing John Day-Oregon City 500-kv line will provide the primary source of power into the new Ostrander Substation thence via this new line into Harris Substation. The new 500/230-kv transformer bank at Harris will provide step down to serve Portland General Electric Company for increased load growth in the Portland, Oregon area. Energization date: October 1969.

HANFORD-FERN PRAIRIE-OSTRANDER: 199 miles, 500-kv from Hanford Substation to Fern Prairie Substation near Camas, Washington, and then to Ostrander Substation. Increased power requirements in the Portland, Oregon area in the Fall of 1972 will be met by the completion of this line on schedule. Energization date: October 1972.

CHIEF JOSEPH-MONROE: 123 miles, 500-kv from Chief Joseph Substation to Monroe Substation near Snohomish, Washington. This line, and the Chief Joseph-Sickler line listed next below, will provide increased peaking power and energy to coastal load centers and provide part of the 500-kv network needed for integration of the third powerhouse at Grand Coulee into the Administration's main grid system. Energization date: October 1971.

CHIEF JOSEPH-SICKLER: 45 miles, 500-kv from Chief Joseph Substation at Chief Joseph Dam to Sickler Substation north of Wenatchee. Energization date: October 1971.

LOWER MONUMENTAL - LITTLE GOOSE: 27 miles, 500-kv from Lower Monumental Substation to Little Goose Substation on the Snake River north-

west of Pomeroy, Washington. Energization date: April 1970.

LITTLE GOOSE - LOWER GRANITE: 28 miles, 500-kv from Little Goose Substation to Lower Granite Substation on the Snake River southwest of Pullman, Washington. Energization date: April 1972.

LOWER GRANITE-ASOTIN: 31 miles, 500-kv from Lower Granite Substation to Asotin Substation on the Snake River south of Lewiston, Idaho. Energization date: April 1972.

ASOTIN-UMATILLA: 123 miles, 500-kv from Asotin Substation to Umatilla Substation near Umatilla, Oregon, and McNary Dam. Energization date: April 1972.

ASOTIN-DWORSHAK: 43 miles, 500-kv from Asotin Substation to Dworshak Substation at Dworshak Dam between Clarkston and Orofino, Idaho. Energization date: April 1972.

The last five transmission lines listed will comprise the Lower Snake Transmission System. They will transmit power from Little Goose, Lower Granite and Dworshak Dams, now being constructed, to the Administration's main system; furnish the capacity required to transmit power from Asotin Dam and others planned for the area; and provide a point of origin for transmission lines which will supply power to Montana.

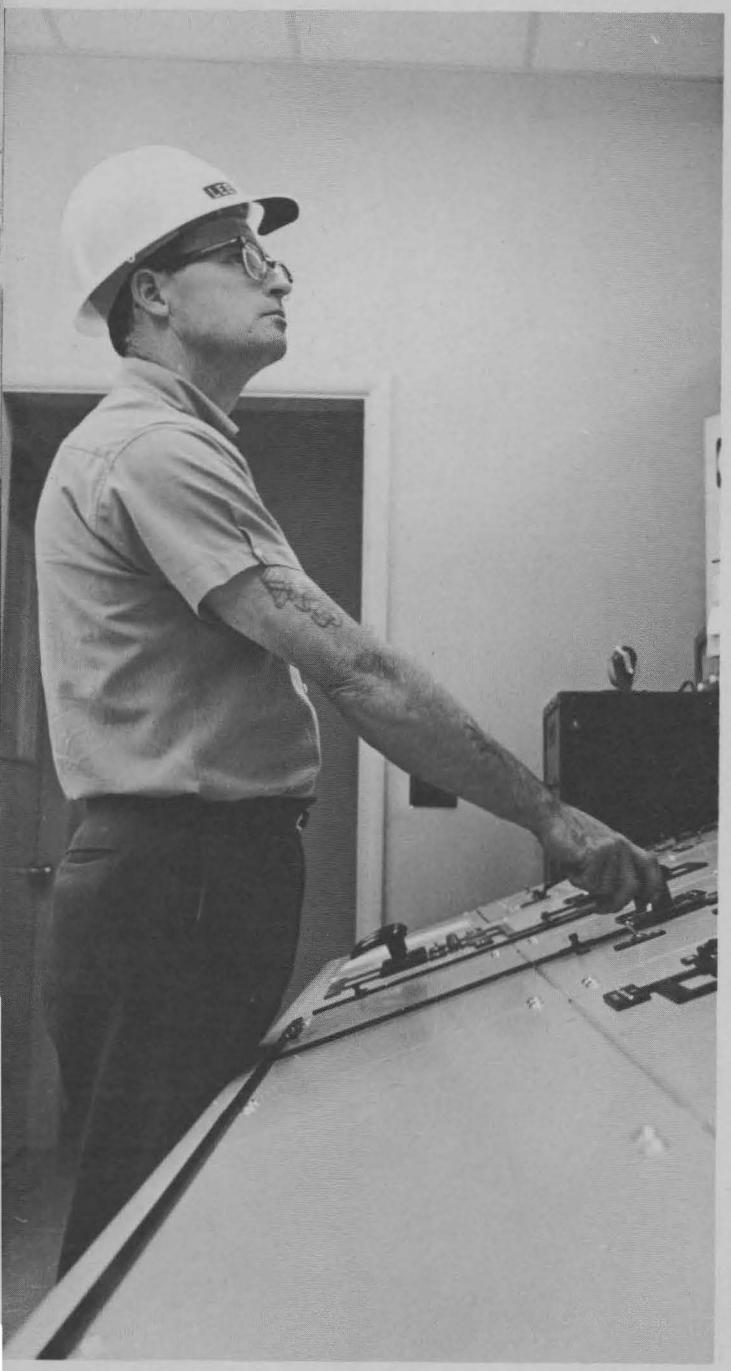
DWORSHAK - HOT SPRINGS: 139 miles 500-kv from Dworshak Substation to Hot Springs Substation near Hot Springs south of Kalispell, Montana. This line will provide the source of power required for western Montana during periods of the year when power production from hydroelectric plants in the area east of Grand Coulee Dam is restricted. Energization date: April 1972.

SANTIAM-TOLEDO-WENDSON: This project consists of two parts totaling 79 miles of new 230-kv line. Twenty-seven miles will be completed from Santiam Substation to Albany Substation where it will interconnect the existing Albany-Toledo line now operating at 115 kv. At the time the new section is completed the new line will operate at 230 kv as the Santiam-Toledo line. The second part will be a 52-mile, 230-kv line from the Toledo Substation to the new Wendson Substation near Florence, Oregon. These new facilities will provide reinforcement for the Oregon Coastal Area transmission and increase the capability required to serve normal load growth. Energization date: December 1970 for part 1 and October 1972 for the Toledo-Wendson line.

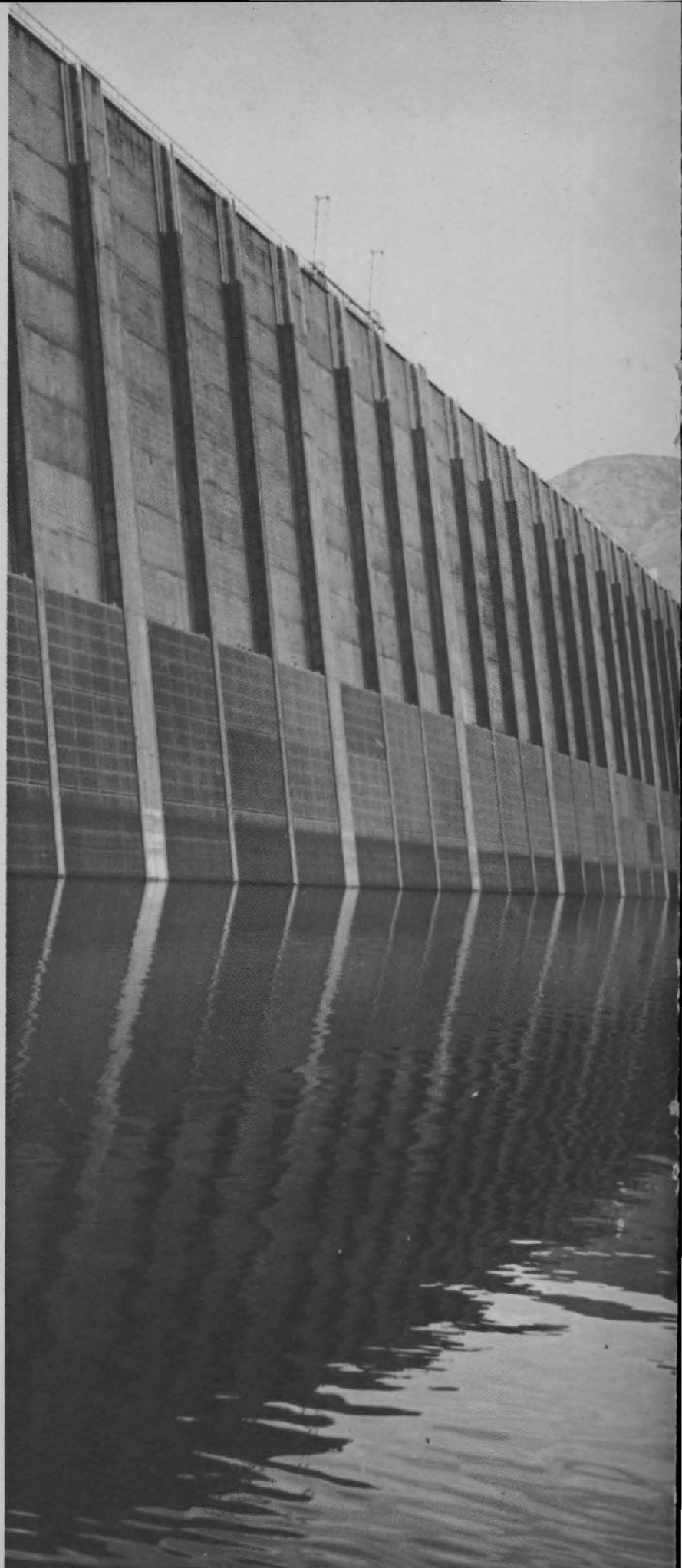
BANDON-GOLD BEACH NO. 2: 46 miles of 230-kv and 5 miles of 115-kv from Bandon Substation to Gold Beach Substation near Gold Beach, Oregon. An acceptable standard of service will be provided to the southwest coastal area of Oregon. Energization date: October 1970.

SYSTEM STATISTICS TABLE (Design Voltage)
(as of June 30, 1967)
Transmission Lines Under Construction F.Y. 1968

Voltage	Circuit Miles in Operation	Circuit Miles Under Construction
750 kv Direct Current		534.0
500 kv	289.7	2040.0
345 kv	731.4	16.0
287 kv	1657.6	
230 kv	3175.0	526.9
138 kv and lower	3994.5	106.0
Totals	9848.2	3222.9



HYDROELECTRIC DAMS IN THE PACIFIC NORTHWEST



Tables

TABLE 1

ELECTRIC ENERGY SALES TO CUSTOMERS OF THE BONNEVILLE POWER ADMINISTRATION

Fiscal Year Ended June 30, 1967

Customers	Energy Delivered for Year (000)	Revenue from Sales of Energy
Publicly Owned Utilities		
Municipalities		
Albion, Idaho	1,962	$ 6,373
Bandon, Oregon	31,749	109,921
Blaine, Washington	521	1,630
Bonners Ferry, Idaho	7,945	40,515
Burley, Idaho	49,459	157,827
Canby, Oregon	29,107	105,970
Cascade Locks, Oregon	11,702	33,096
Centralia, Washington	31,228	172,478
Cheney, Washington	44,278	145,471
Consolidated Irrigation District #19	461	4,037
Coulee Dam, Washington	19,779	37,710
Declo, Idaho	1,494	4,948
Drain, Oregon	20,987	72,986
Ellensburg, Washington	90,565	292,008
Eugene, Oregon	744,744	1,721,457
Forest Grove, Oregon	76,812	259,878
Grand Coulee, Washington	23,528	52,873
Heyburn, Idaho	35,236	110,408
Idaho Falls, Idaho	134,792	412,707
McCleary, Washington	21,578	72,231
McMinnville, Oregon	109,101	358,911
Milton-Freewater, Oregon	64,926	209,700
Minidoka, Idaho	669	2,321
Monmouth, Oregon	34,549	118,839
Port Angeles, Washington	312,779	855,296
Richland, Washington	217,660	709,723
Rupert, Idaho	29,994	96,831
Seattle, Washington	3,157,644	6,793,325
Springfield, Oregon	173,176	528,553
Tacoma, Washington	1,407,785	3,052,135
Vera Irrigation District #15	52,505	169,352
Washington Public Power Sup. Syst.	26,356	65,894
Total Municipalities (32)	6,965,071	$16,775,404
Public Utility Districts		
Benton Co. PUD No. 1	425,228	1,188,634
Central Lincoln PUD	637,357	1,906,230
Chelan Co. PUD No. 1	200,946	471,519
Clallam Co. PUD No. 1	135,404	403,296
Clark Co. PUD No. 1	1,120,935	3,431,587
Clatskanie PUD	254,506	747,992
Cowlitz Co. PUD No. 1	1,431,621	3,384,687
Douglas Co. PUD No. 1	231,582	619,722
Ferry Co. PUD No. 1	27,705	81,255
Franklin Co. PUD No. 1	236,497	743,224
Grant Co. PUD No. 2	350,349	1,123,110
Grays Harbor Co. PUD No. 1	672,605	1,811,586
Kittitas Co. PUD No. 1	17,298	53,841
Klickitat Co. PUD No. 1	109,536	330,082
Lewis Co. PUD No. 1	260,988	806,532
Mason Co. PUD No. 1	18,848	60,225
Mason Co. PUD No. 3	158,318	491,678
Northern Wasco Co. PUD	45,412	148,611
Okanogan Co. PUD No. 1	210,957	622,216
Pacific Co. PUD No. 2	127,911	425,691
Pend Oreille Co. PUD No. 1	24,765	56,016
Skamania Co. PUD No. 1	52,916	179,281
Snohomish Co. PUD No. 1	2,027,405	5,998,055
Tillamook PUD	207,033	703,524
Wahkiakum Co. PUD No. 1	25,850	86,673
Whatcom Co. PUD No. 1	71,403	166,043
Total Public Utility Dist. (36)	9,083,375	$26,041,310
B.C. Hydro & Power Authority	243,533	1,191,256
Total Pub. Owned (104)	18,582,936	$51,289,050
Privately Owned Utilities		
California-Pacific Utilities	23,830	61,600
Idaho Power Co.	194,554	500,775
Montana Power Co.	839,623	1,998,187
Pacific Power & Light Co.	2,468,828	5,287,703
Portland General Electric Co.	2,146,301	4,606,634
Puget Sound Power & Light Co.	19,461	48,654
Utah Power Co.	639	1,278
Washington Water Power Co.	214,011	531,915
Total Priv. Owned Util. (8)	5,907,247	$13,036,746
Cooperatives		
Benton Rural Elec. Assn.	84,704	259,524
Big Bend Elec. Coop.	149,504	399,177
Blachly Lane Co. Coop. Elec. Assn.	56,008	188,930
Central Electric Coop.	47,194	137,302
Clearwater Power Company	67,196	226,954
Columbia Basin Elec. Coop.	51,722	166,379
Columbia Power Coop.	22,757	77,932
Columbia Rural Elec. Assn.	50,029	140,273
Consumers Power	163,092	569,857
Coos-Curry Elec. Coop.	162,549	549,753
Douglas Elec. Coop.	61,117	208,344
East End Mutual Elec. Co.	2,973	10,234
Fall River Elec. Coop.	22,581	86,842
Farmers Elec. Coop.	2,461	7,979
Flathead Elec. Coop.	37,116	115,856
Harney Elec. Coop.	59,047	156,796
Hood River Elec. Coop.	41,409	134,431
Idaho Co. L & P Coop. Assn.	21,957	71,068
Inland P & L Co.	187,514	595,797
Kootenai Elec. Coop.	35,791	111,884
Lane Co. Elec. Coop.	152,831	534,656
Lincoln Elec. Coop.—Montana	32,190	109,220
Lincoln Elec. Coop.—Washington	51,548	150,071
Lost River Elec. Coop.	17,166	49,383
Lower Valley P & L Inc.	52,635	172,907
Midstate Elec. Coop.	33,771	95,894
Missoula Elec. Coop.	27,660	85,938
Nespelem Valley Elec. Coop.	12,712	38,003
Northern Lights	49,863	164,660
Okanogan Co. Elec. Coop.	8,718	27,276
Orcas P & L Co.	34,158	106,683
Prairie Power Coop.	1,817	6,363
Raft River Rural Coop.	83,188	221,180
Ravalli Co. Elec. Coop.	27,099	89,331
Riverside Elec. Co.	2,224	7,735
Rural Elec. Co.	21,754	70,928
Salem Electric	111,792	373,325
Salmon River Elec. Coop.	12,398	34,388
South Side Elec. Lines	8,881	26,392
Surprise Valley Elec. Corp.	29,281	90,675
Tanner Electric	4,391	14,398
Umatilla Elec. Coop. Assn.	76,514	230,569
Unity Light & Power Co.	16,619	54,698
Wasco Elec. Coop.	60,914	200,049
West Oregon Elec. Coop.	34,112	111,046
Total Cooperatives (45)	2,290,957	$ 7,281,080
Federal Agencies (9)	2,172,511	5,315,159
Industries		
Aluminum		
Aluminum Co. of America		
Vancouver Plant	1,877,825	3,861,088
Wenatchee Plant	680,460	1,398,344
Anaconda Aluminum Co.	1,924,871	3,498,323
Harvey Aluminum Co.	1,522,811	2,600,465
Intalco Aluminum Co.	1,616,236	3,516,240
Kaiser Alum. & Chem. Corp.		
Spokane Reduction Plant	3,729,381	7,622,003
Spokane Rolling Mill	363,127	914,872
Tacoma Reduction Plant	721,678	1,486,885
Reynolds Metals Co.		
Longview Plant	1,235,433	2,536,581
Troutdale Plant	1,439,591	2,936,802
Other Industries		
Carborundum Co.	220,911	465,384
Cominco American, Inc.	41,394	143,714
Crown Zellerbach Corp.	98,141	222,913
Georgia-Pacific Corp.	150,832	340,966
Hanna Nickel Smelting Co.	727,577	1,576,952
Ida Gem Dairymen	276	1,545
Keokuk Electro-Metals Co.	114,190	252,580
Pacific Carbide & Alloys	58,491	129,061
Pennsalt Chemical Corp.	336,711	695,443
Rayonier, Incorporated	44,751	99,112
Stauffer Chemical Co.	383,362	872,311
Stewart Elsner	44	275
Union Carbide Metals Co.	48,665	104,789
Total Industries (23)	17,336,758	$ 35,276,648
Total Sales of Elec. Energy (144)	43,999,452	$104,917,603

TABLE 2

U.S. COLUMBIA RIVER POWER SYSTEM

General Specifications, Projects Existing, Under Construction and Authorized Installations as of June 30, 1967

				Existing			Under Construction		Authorized		Total	
Project	Operating Agency 1/	Location	Stream	Initial Date in Service	Number of Units	Total Capacity Kilowatts 2/	Number of Units	Total Capacity Kilowatts 2/	Number of Units	Total Capacity Kilowatts 2/	Number of Units	Total Capacity Kilowatts 2/
Bonneville	CE	Ore.-Wash.	Columbia	June 1938	10	518,400	—	—	6	324,000	16	842,400
Grand Coulee	BR	Washington	Columbia	Sept. 1941	18	1,944,000	6	3,600,000	6	291,000	36	9,435,000 3/
Hungry Horse	BR	Montana	S. Fk. Flathead	Oct. 1952	4	285,000	—	—	—	—	4	285,000
Detroit	CE	Oregon	North Santiam	July 1953	2	100,000	—	—	—	—	2	100,000
McNary	CE	Ore.-Wash.	Columbia	Nov. 1953	14	980,000	—	—	6	420,000	20	1,400,000
Big Cliff	CE	Oregon	North Santiam	June 1954	1	18,000	—	—	—	—	1	18,000
Lookout Point	CE	Oregon	M. Fk. Willamette	Dec. 1954	3	120,000	—	—	—	—	3	120,000
Albeni Falls	CE	Idaho	Pend Oreille	Mar. 1955	3	42,600	—	—	—	—	3	42,600
Dexter	CE	Oregon	M. Fk. Willamette	May 1955	1	15,000	—	—	—	—	1	15,000
Chief Joseph	CE	Washington	Columbia	Aug. 1955	16	1,024,000	—	—	11	704,000	27	1,728,000
Chandler	BR	Washington	Yakima	Feb. 1956	2	12,000	—	—	—	—	2	12,000
The Dalles	CE	Ore.-Wash.	Columbia	May 1957	16	1,119,000	8	688,000	—	—	24	1,807,000
Roza	BR	Washington	Yakima	Aug. 1958	1	11,250	—	—	—	—	1	11,250
Ice Harbor	CE	Washington	Snake	Dec. 1961	3	270,000	—	—	3	270,000	6	540,000
Hills Creek	CE	Oregon	M. Fk. Willamette	May. 1962	2	30,000	—	—	—	—	2	30,000
Minidoka	BR	Idaho	Snake	May 1909	7	13,400	—	—	—	—	7	13,400
Boise Diversion	BR	Idaho	Boise	May 1912	3	1,500	—	—	—	—	3	1,500
Black Canyon	BR	Idaho	Payette	Dec. 1925	2	8,000	—	—	—	—	2	8,000
Anderson Ranch	BR	Idaho	S. Fk. Boise	Dec. 1950	2	27,000	—	—	1	13,500	3	40,500
Palisades	BR	Idaho	Snake	Feb. 1957	4	114,000	—	—	—	—	4	114,000
Cougar	CE	Oregon	S. Fk. McKenzie	Feb. 1964	2	25,000	—	—	1	35,000	3	60,000
Green Peter	CE	Oregon	Middle Santiam	June 1967	2	80,000	—	—	—	—	2	80,000
Foster	CE	Oregon	South Santiam		—	—	2	20,000	—	—	2	20,000
John Day	CE	Ore.-Wash.	Columbia		—	—	16	2,160,000	4	540,000	20	2,700,000
Lower Monumental	CE	Washington	Snake		—	—	3	405,000	3	405,000	6	810,000
Little Goose	CE	Washington	Snake		—	—	3	405,000	3	405,000	6	810,000
Lower Granite	CE	Washington	Snake		—	—	3	405,000	3	405,000	6	810,000
Teton	BR	Idaho	Teton		—	—	—	—	2	22,000	2	22,000
Lost Creek	CE	Oregon	Rogue		—	—	2	49,000	—	—	2	49,000
Dworshak	CE	Idaho	N. Fk. Clearwater		—	—	3	400,000	3	660,000	6	1,060,000
Strube	CE	Oregon	S. Fk. McKenzie		—	—	—	—	1	4,500	1	4,500
Libby	CE	Montana	Kootenai		—	—	4	420,000	4	420,000	8	840,000
Asotin	CE	Wash.-Ida.	Snake		—	—	—	—	4	540,000	4	540,000
Total number of projects and Installed Capacity					22	6,758,150	8	8,552,000	3	5,459,000	33	24,369,150

1/ CE—Corps of Engineers; BR—Bureau of Reclamation.

2/ Nameplate Rating.

3/ Includes a recommended 3,600,000 kw at the Third Powerhouse in addition to that under construction and 291,000 kw from 6 authorized pump-turbine units.

TABLE 3

PACIFIC NORTHWEST GENERATION

Nameplate Rating of Plants Existing, Under Construction and Authorized or Licensed

Kilowatts

June 30, 1967

Ownership	Existing		Under Construction		Authorized or Licensed		Total	
	No. of Plants	Nameplate Rating	No. of Plants	Nameplate Rating	No. of Plants	Nameplate Rating	No. of Plants	Nameplate Rating
Federal Agencies								
Hydro	27	6,778,670	8	8,552,000 1/	3	5,459,000 1/	38	20,789,670 1/
Thermal	7	18,562	0	0	0	0	7	18,562
Total Federal Agencies	34	6,797,232	8	8,552,000	3	5,459,000	45	20,808,232 1/
Publicly Owned Agencies								
Hydro	42	3,885,636	4	1,625,450	3	569,400 1/	49	6,080,486 1/
Thermal	19	986,019	0	0	0	0	19	986,019
Total Publicly Owned Agencies	61	4,871,655	4	1,625,450	3	569,400 1/	68	7,066,505 1/
Privately Owned Agencies								
Hydro	95	3,480,592	2	455,500	0	0	97	3,936,092
Thermal	13	263,935	0	5,500 1/	0	0	13	269,435 1/
Total Privately Owned Agencies	108	3,744,527	2	461,000 1/	0	0	110	4,205,527 1/
Pacific Northwest Agencies								
Hydro	164	14,144,898	14	10,632,950 1/	6	6,028,400 1/	184	30,806,248 1/
Thermal	39	1,268,516	0	5,500 1/	0	0	39	1,274,016 1/
Total Pacific Northwest Agencies	203	15,413,414	14	10,638,450 1/	6	6,028,400 1/	223	32,080,264 1/

1/ Includes additions to projects existing or under construction.

TABLE 4

ELECTRIC ENERGY ACCOUNT FOR FISCAL 1967

Energy Received (millions of kilowatt-hours)	
Energy Generated for BPA	
Bureau of Reclamation	16,011
Corps of Engineers	28,374
Washington Public Power Supply System	2,210
Power Interchanged In	19,686
Total Received	66,281
Energy Delivered (millions of kilowatt-hours)	
Sales	43,999
Power Interchanged Out	19,214
Used by Administration	44
Total Delivered	63,257
Energy losses in transmission and transformation Total	3,024
Losses in percent of total received—4.6%	
Maximum demand on Federal plants (kilowatts) March 10, 1967, 6-7 p.m. PST	6,941,000
Load Factor in percent of total generated for BPA	76.6%

TABLE 5

GENERATION BY THE PRINCIPAL ELECTRIC UTILITIES SYSTEMS OF THE PACIFIC NORTHWEST 1/

Fiscal Year 1967

Utilities	Kilowatt-hours (Billion)	Of Total Generation (Percent)
Publicly Owned:		
U.S. Columbia River System 2/	45.8	53.7
Grant County PUD	8.5	10.0
Chelan County PUD	5.9	6.9
Seattle City Light	2.4	2.8
Tacoma City Light	1.7	2.0
Pend Oreille County PUD	0.5	0.6
Eugene Water & Electric Board	0.4	0.5
Total Publicly Owned	65.2	76.5
Privately Owned:		
Idaho Power Company	5.1	6.0
Pacific Power & Light Co.	4.4	5.2
Montana Power Company	3.9	4.5
Washington Water Power Co.	3.4	4.0
Portland General Electric Co.	2.2	2.6
Puget Sound Power & Light Co.	1.0	1.2
Total Privately Owned	20.0	23.5
Total Generation	85.2	100.0

1/ Generation shown is for members of the Northwest Power Pool plus Pend Oreille County PUD and Washington Public Power Supply System. Utah Power & Light Co., British Columbia Hydro and Power Authority, West Kootenay Power & Light and U.S. Bureau of Reclamation, who are members of the Power Pool, are not included because their service area lies outside the Pacific Northwest region.

2/ Includes generation from the Washington Public Power Supply System's Hanford steam plant (NPR).

TABLE 6

COLUMBIA RIVER FEDERAL POWER SYSTEM

Operating Results on the Repayment Basis
Fiscal Years 1967 and 1966

(In thousands of dollars)

			Increase (Decrease)	
REVENUES	F.Y. 1967	F.Y. 1966	Amount	Percent
Bonneville Power Administration				
Sales of electric energy:				
Publicly owned utilities	51,126	48,516	2,610	5.4
Privately owned utilities	12,753	9,262	3,491	37.7
Federal agencies	5,310	5,571	(261)	(4.7)
Aluminum industry	30,371	26,293	4,078	15.5
Other industry	4,905	5,370	(465)	(8.7)
Total	104,465	95,012	9,453	9.9
Other operating revenues:				
Wheeling revenues	4,504	4,314	190	4.4
Other revenues	1,195	1,135	60	5.3
Total	5,699	5,449	250	4.6
Total Bonneville Power Administration revenues	110,164	100,461	9,703	9.7
Associated Projects				
Other operating revenues	2,664	2,707	(43)	(1.6)
Total power system operating revenues	112,828	103,168	9,660	9.4
EXPENSES				
Purchase and exchange power	9,644	1,226	8,418	686.6
Operation expenses	18,112	17,305	807	4.7
Maintenance and other expenses	10,869	10,335	534	5.2
Total power system expenses	38,625	28,866	9,759	33.8
INTEREST				
Interest on Federal investment	38,004	36,676	1,328	3.6
Less interest charged to construction	2,451	1,152	1,299	112.8
Total power system interest	35,553	35,524	29	.1
Total power system expenses and interest	74,178	64,390	9,788	15.2
BALANCE AVAILABLE FOR REPAYMENT OF POWER SYSTEM INVESTMENT AND REPLACEMENTS	38,650	37,778	(128)	(0.3)

TABLE 7

COLUMBIA RIVER FEDERAL POWER SYSTEM — REPAYMENT STUDY

Authorized Projects

(All Amounts in $1,000)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
				Plant Allocated to Commercial Power							Irrigation Assistance			
Fiscal Year	Revenues	Operation and Maintenance Expense	Replacements (Annuity Basis)	Interest Expense	Investment Placed in Service	Cumulative Investment in Service	Amortization	Unamortized Investment	Allowable Unamortized Investment	Cumulative Amount in Service	Amortization	Unamortized Amount	Allowable Unamortized Amount	Cumulative Surplus Revenues
Cumulative to 6-30-67	1,367,110	404,375	—	468,383	1,902,986	1,902,986	494,352	1,408,634	1,901,440	360,520		360,520	360,520	
1968	126,600	43,631	12,366	36,906	222,864	2,125,850	33,697	1,597,801	2,054,670	376,503				
69	139,800	47,694	14,853	41,862	302,199	2,428,049	35,391	1,864,609	2,165,270	398,176				
1970	153,900	50,643	15,607	48,853	466,837	2,894,886	38,797	2,292,649	2,568,383	416,752				
71	167,500	53,661	18,664	60,067	88,600	2,983,486	35,108	2,346,141	2,656,983	429,354				
72	178,100	54,846	20,230	61,469	692,223	3,675,709	41,555	2,996,809	3,631,663	445,676				
73	193,100	63,420	21,160	81,513	121,168	3,796,877	27,007	3,090,970	3,774,849	469,474				
74	201,800	69,007	22,454	84,074	518,540	4,315,417	26,265	3,583,245	4,124,066	493,029				
1975	213,500	71,365	24,619	97,464	196,375	4,511,792	20,052	3,759,568	4,465,683	511,815				
76	221,100	74,164	24,635	102,260	203,201	4,714,993	20,041	3,942,728	4,713,447	529,179		Same as Column 11	Same as Column 11	
77	232,100	75,395	25,892	107,242	1,800	4,716,793	23,571	3,920,957	4,715,247	547,332				
78	239,400	76,571	26,388	111,355	252,375	4,969,168	25,086	4,148,246	4,826,947	565,989				
79	249,100	78,095	26,388	117,810	101,731	5,070,899	26,807	4,223,170	5,069,353	582,539				
1980	254,600	78,561	27,040	119,938	7,050	5,077,949	29,061	4,201,159	5,076,403	596,311				
81	265,200	79,293	27,254	119,313	43,350	5,121,299	39,340	4,205,169	5,119,753	617,199				
82	270,600	80,331	27,254	119,427	64,724	5,186,023	43,588	4,226,305	5,174,703	634,563				
83	272,400	81,294	27,828	120,450	42,678	5,228,701	42,828	4,226,155	5,227,155	652,716				
84	275,900	81,836	27,828	120,445	44,036	5,272,737	45,791	4,224,400	5,257,044	673,238				
1985	279,500	82,623	28,170	120,395	62,934	5,335,671	48,312	4,239,022	5,309,260	687,443				
86	281,600	83,193	28,567	120,812	33,632	5,369,303	49,028	4,223,626	5,342,751	701,648				
87	284,200	83,622	28,873	120,373	14,537	5,383,840	51,332	4,186,831	5,354,521	716,645				
88	288,700	84,262	29,256	119,325	113,660	5,497,500	55,857	4,244,634	5,463,176	734,009				
89	290,000	84,494	29,585	122,245	0		53,676	4,190,958	5,429,570	751,368				
1990	290,334	85,994	29,646	120,700			53,994	4,136,964	5,419,028					
91	290,234	86,394	30,053	119,145			54,642	4,082,322	5,412,274					
92	290,734	86,494	30,247	117,571			56,422	4,025,900	5,406,447					
93	291,234	86,494	30,826	115,946			57,968	3,967,932	5,393,781					
94	291,734	86,494	31,303	114,276			59,661	3,908,271	5,321,282					
1995	292,234	86,594		112,558			61,779	3,846,492	5,286,369					
96	292,834	86,994		110,779			63,758	3,782,734	5,261,823			751,368	751,368	
97	281,734	65,794		108,943			64,901	3,717,833	5,230,667		10,793	740,575	740,575	
98	280,634	61,494		107,074			80,763	3,637,070	5,175,613			740,575	740,575	
99	280,634	61,494		104,748			83,089	3,553,981	5,130,592			740,575	740,575	
2000	280,734			102,355			85,582	3,468,399	5,095,565			740,575	740,575	
01	280,834			99,890			70,800	3,397,599	5,055,043		17,347	723,228	723,228	
02	281,134			97,851			90,486	3,307,113	4,851,174			723,228	723,228	
03	281,034			95,245			92,992	3,214,121	4,818,881			723,228	723,228	
04	281,334			92,567			95,189	3,118,932	4,677,956		781	722,447	722,447	
2005				89,825			98,712	3,020,220	4,626,928			722,447	722,447	
06				86,982			101,555	2,918,665	4,573,926			722,447	722,447	
07				84,058			104,479	2,814,186	4,280,870			722,447	722,447	
08				81,049			107,488	2,706,698	4,254,304			722,447	722,447	
09				77,953			103,074	2,603,624	4,080,594		7,510	714,937	714,937	
2010				74,984			113,553	2,490,071	4,047,389			714,937	714,937	
11				71,714			116,823	2,373,248	3,788,037			714,937	714,937	
12				68,350			119,629	2,253,619	3,638,665		558	714,379	714,379	
13				64,904			95,653	2,157,966	3,508,665		27,980	686,399	686,399	
14				62,149			95,179	2,062,787	3,381,039		31,209	655,190	655,190	
2015				59,408			103,294	1,959,493	3,244,939		25,835	629,355	629,355	
16				56,433			100,960	1,858,533	3,156,339		31,144	598,211	598,211	
17				53,526			108,547	1,749,986	2,931,159		26,464	571,747	571,747	
18				50,400			118,954	1,631,032	2,860,429		19,183	552,564	552,564	
19				46,974			107,614	1,523,418	2,819,929		33,949	518,615	518,615	
2020				43,874			126,554	1,396,864	2,487,616		18,109	500,506	500,506	
2021				40,230			141,902	1,254,962	2,474,816		6,405	494,101	494,101	
22				36,143			145,356	1,109,606	1,696,391		7,038	487,063	487,063	
23				31,957			150,473	959,133	1,516,405		6,107	480,956	480,956	
24				27,623			149,212	809,921	1,176,188		11,702	469,254	469,254	
2025				23,326			152,443	657,478	894,771		12,768	456,486	456,486	
26				18,935			147,500	509,978	638,507		22,102	434,384	434,384	
27				14,687			167,525	342,453	605,607		6,325	428,059	428,059	
28				9,863			173,226	169,227	555,107		5,448	422,611	422,611	
29				4,874			169,227	0	327,801		14,436	408,175	417,312	
2030				0					295,151		188,537	219,638	412,469	
31									255,401		188,537	31,101	408,808	
32									226,251		31,101	0	401,020	157,436
33									174,799				375,759	345,973
34									159,763				360,155	534,510
2035									134,563				338,510	723,047
36									106,435				323,800	911,584
37									91,560				310,369	1,100,121
38									0				294,896	1,288,658
39													275,441	1,447,195
2040													255,281	1,665,732
41													237,552	1,854,269
42													226,501	2,042,806
43													209,137	2,231,343
44													190,984	2,419,880
2045													175,198	2,608,417
46													161,781	2,796,954
47													151,533	2,985,491
48													134,169	3,174,028
49													116,805	3,362,565
2050													98,652	3,551,102
51													78,130	3,739,639
52													63,925	3,928,176
53													49,720	4,116,713
54													34,723	4,305,250
2055													17,359	4,493,787
56	281,334	61,494	31,303	0		5,497,500		0		751,368	0	0	0	4,682,324
TOTALS	25,362,588	6,281,774	2,627,772	5,521,850	5,497,500		5,497,500				751,368			4,682,324

TABLE 8

UNITED STATES DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
REVENUE AND REVENUE TRENDS

Sales of energy, firm and nonfirm
by class of customer and miscellaneous power revenues

Class of Customer	F.Y. 1958	F.Y. 1959	F.Y. 1960	F.Y. 1961	F.Y. 1962	F.Y. 1963	F.Y. 1964	F.Y. 1965	F.Y. 1966	F.Y. 1967
	(In thousands of dollars)									
Aluminum Industry										
Firm	$13,980	$14,228	$15,293	$14,978	$14,341	$14,382	$15,733	$16,068	$17,299	$21,652
Nonfirm	3,512	2,384	2,168	1,982	3,042	3,715	5,397	6,930	8,994	8,719
Total aluminum industry	17,492	16,612	17,461	16,960	17,383	18,097	21,030	22,998	26,293	30,371
Trend percentages 1/	100%	95%	100%	97%	99%	103%	120%	131%	150%	174%
Other Industry										
Firm	3,006	3,138	3,163	3,205	3,194	2,927	3,431	3,608	3,801	3,776
Nonfirm	407	680	868	613	855	625	1,064	1,342	1,569	1,129
Total other industry	3,413	3,818	4,031	3,818	4,049	3,552	4,495	4,950	5,370	4,905
Trend percentages 1/	100%	112%	118%	112%	119%	104%	132%	145%	157%	144%
Publicly Owned Utilities										
Firm	22,593	24,861	28,304	29,520	32,598	35,466	36,965	41,231	46,643	50,215
Nonfirm	981	768	357	583	1,340	682	746	507	1,873	911
Total publicly owned utilities	23,574	25,629	28,661	30,103	33,938	36,148	37,711	41,738	48,516	51,126
Trend percentages 1/	100%	109%	122%	128%	144%	153%	160%	177%	206%	217%
Privately Owned Utilities										
Firm	11,526	11,846	9,907	8,338	5,678	6,900	4,974	4,874	7,743	11,062
Nonfirm	2,645	2,552	2,659	1,301	1,536	332	781	663	1,519	1,691
Total privately owned utilities	14,171	14,398	12,566	9,639	7,214	7,232	5,755	5,537	9,262	12,753
Trend percentages 1/	100%	102%	89%	68%	51%	51%	41%	39%	65%	90%
Federal Agencies										
Firm	5,860	6,015	5,986	6,194	6,217	6,646	7,088	5,874	3,346	5,199
Nonfirm	194	388	239	281	253	303	183	872	2,252	111
Total Federal agencies	6,054	6,403	6,225	6,475	6,470	6,949	7,271	6,746	5,571	5,310
Trend percentages 1/	100%	106%	103%	107%	107%	115%	120%	111%	92%	88%
Sales of Electric Energy										
Firm	56,965	60,088	62,653	62,235	62,028	66,321	68,191	71,655	78,832	91,904
Nonfirm	7,739	6,772	6,291	4,760	7,026	5,657	8,071	10,314	16,180	12,561
Total sales of electric energy	64,704	66,860	68,944	66,995	69,054	71,978	76,262	81,969	95,012	104,465
Trend percentages 1/	100%	103%	107%	104%	107%	111%	118%	127%	147%	161%
Miscellaneous Revenues										
Wheeling revenues	746	1,445	1,798	2,317	4,019	3,878	4,359	4,397	4,314	4,504
Downstream benefits	13	38	—	—	1,100	1,460	1,881	112	271	103
All other	1,112	131	256	390	310	388	349	807	864	1,092
Total miscellaneous revenues	1,871	1,614	2,054	2,707	5,429	5,726	6,589	5,316	5,449	5,699
Trend percentages 1/	100%	86%	110%	145%	290%	306%	352%	284%	291%	305%
Total Revenues	66,575	68,474	70,998	69,702	74,483	77,704	82,851	87,285	100,461	110,164
Trend percentages 1/	100%	103%	107%	105%	112%	117%	124%	131%	151%	165%

1/ F.Y. 1958 base year.

Financial Statements

COMPTROLLER GENERAL OF THE UNITED STATES WASHINGTON, D.C. 20548

Jan. 22, 1968

B-114858

Dear Mr. Secretary:

The General Accounting Office has examined the accompanying financial statements prepared by the Bonneville Power Administration, Department of the Interior, for the Columbia River Federal Power System for fiscal year 1967. The designation "Columbia River Federal Power System" is used to describe the integrated Federal power system in the Pacific Northwest, consisting of (1) power generating facilities of the Corps of Engineers (Civil Functions), Department of the Army, and of the Bureau of Reclamation, Department of the Interior, and (2) transmission facilities of the Bonneville Power Administration. The Administration markets the power generated by the integrated system. Our examination was made pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

The statements present the financial results of operations and the source and application of funds in the generating, transmitting, and marketing of electric power for fiscal year 1967 and the financial position of the System at June 30, 1967. The statements are presented on a comparative basis with those for fiscal year 1966.

Our examination of the financial statements was made in accordance with generally accepted auditing standards and included such tests of the accounting records of the Corps of Engineers, the Bureau of Reclamation, and the Bonneville Power Administration and such other auditing procedures as we considered necessary in the circumstances. Our previous examination of financial statements of the System was made for fiscal year 1966.

The fiscal year 1967 statements include for the first time the Administration's cost of purchasing power and the revenues received from marketing power in connection with the operation of the Hanford Steam Plant. (See note 9 to the financial statements.) The steam plant was constructed by the Washington Public Power Supply System (Supply System) and was financed by a revenue bond issue repayable by 1996. Under exchange agreements between the Administration, the Supply System, and the 76 participating public and private utilities, the Supply System furnishes to the Administration the total electric power generated and the Administration, in turn, furnishes to each participating public and private utility an amount of firm power that is equal in value to each participant's share of the budgeted annual costs to operate the steam plant, including payments to retire the bonds.

The exchange agreements provide that, should the Hanford Steam Plant become inoperable during the bond repayment period, the Administration will still be required to provide electric energy and capacity to the participants in an amount equal in value to the total charges of the project, including all payments required under the bond resolution. Also, the Government has the option to acquire ownership of the plant, subject to congressional approval. If the option is exercised after 1996, the Government may acquire ownership of the steam plant at no cost and assume its assets and liabilities.

Late in fiscal year 1966, the Corps of Engineers converted to the compound-interest method of depreciating plant costs, consistent with similar action previously taken by the Bonneville Power Administration and the Bureau of Reclamation. Depreciation was computed by the Corps through fiscal year 1966, using shortcut procedures, because time did not permit computing the adjustments by customary procedures. Our fiscal year 1966 audit showed that, although the shortcut procedures produced a reasonably accurate estimate of depreciation at June 30, 1966, considering all projects combined, depreciation for certain individual projects was materially misstated. In fiscal year 1967, the Corps made final depreciation adjustments, using more acceptable procedures. (See note 3 to the financial statements.)

In fiscal year 1967, the Corps and the Administration revised the estimated lives used in computing depreciation of generating and transmission facilities. As a result, the average depreciation life of Corps generating facilities was extended from 64 to 85 years--which is now more in line with the 81 years' average life used by the Bureau--and the depreciation life of the Administration's transmission facilities was extended from 38 to 45 years.

The net financial effect of changing the method of computing depreciation and extending the estimated depreciation lives for Corps' generating facilities was an increase in accumulated net power revenues of about $32.8 million through June 30, 1966. As a result of the revisions to depreciation lives, fiscal year 1967 net power revenues were increased by about $3.7 million for Corps projects and by about $2.3 million for Administration transmission facilities.

The accounts and financial statements are subject to further adjustment, because firm allocations of the cost of joint-use facilities to power and other purposes have not been made for eight of the 17 generating projects in operation at June 30, 1967. (See note 5 to the financial statements.) The cost of joint-use facilities of the eight projects amounted to about $470.8 million at June 30, 1967, of which about $201.2 million was tentatively allocated to power. In prior years, such changes in allocations have sometimes resulted in significant adjustments to (1) the costs of joint-use facilities allocated to power and (2) the results of power operations.

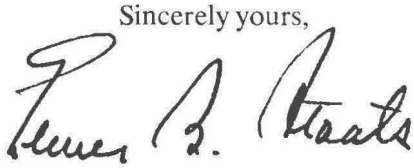
The Department of the Army advised us in January 1967 that the Corps expected to adopt firm cost allocations for all Corps projects prior to the issuance of this report. However, as of December 31, 1967, the allocations were still being considered.

In addition to the need for firm cost allocations, there are other matters discussed in the notes to the financial statements that remain to be resolved for improved disclosure of the financial position and results of operations of the integrated power system. These other matters include (1) inconsistencies in the computation of interest expense on the Federal investment and in the capitalization of interest costs during construction, (2) an inconsistency in capitalization of preliminary survey and investigation costs, (3) the exclusion from the accounts of the costs of space rental and audit service provided by other Federal agencies, and (4) the exclusion from the accounts of certain liabilities for accrued annual leave.

Subject to the financial effects, not now fully determinable, of future adjustments for adoption of firm cost allocations and of the resolution of the other matters described above, the accompanying financial statements, in our opinion, present fairly the assets and liabilities of the Columbia River Federal Power System at June 30, 1967, the financial results of its power operations, and the source and application of its funds for the year then ended, in conformity with accounting principles and standards prescribed for executive agencies of the Federal Government by the Comptroller General of the United States, applied on a basis consistent with that of the preceding period.

Copies of this report are being sent today to the Administrator, Bonneville Power Administration, the Commissioner of Reclamation, the Secretary of the Army, and the Chief of Engineers.

Sincerely yours,



Comptroller General
of the United States

Enclosures
The Honorable
The Secretary of the Interior

EXHIBIT 1

UNITED STATES OF AMERICA

COLUMBIA RIVER FEDERAL POWER SYSTEM

STATEMENT OF COMMERCIAL POWER REVENUES AND EXPENSES
FOR THE FISCAL YEARS ENDED JUNE 30, 1967 AND JUNE 30, 1966

(NOTES 1 AND 2)

(In thousands of dollars)

	Fiscal Year 1967	Fiscal Year 1966
OPERATING REVENUES:		
Sales of electric energy by Bonneville Power Administration:		
Publicly owned utilities	51,126	48,516
Privately owned utilities	12,753	9,262
Federal agencies	5,310	5,571
Aluminum industry	30,371	26,293
Other industry	4,905	5,370
Total	104,465	95,012
Other operating revenues:		
Wheeling revenues	4,504	4,314
Other revenues	3,859	3,842
Total	8,363	8,156
Total operating revenues	112,828	103,168
OPERATING EXPENSES:		
Purchase and exchange power (Note 9)	9,644	1,226
Operation	18,112	17,305
Maintenance	10,093	10,342
Depreciation (Note 3)	15,836	21,222
Total operating expenses	53,685	50,095
Net operating revenues	59,143	53,073
INTEREST AND OTHER DEDUCTIONS (Note 4)		
Interest on Federal investment	38,005	36,676
Interest charged to construction	2,451*	1,152*
Miscellaneous income deductions, net	775	7*
Net interest and other deductions	36,329	35,517
NET REVENUES	22,814	17,556
ACCUMULATED NET REVENUES:		
Balance at beginning of year	222,869	202,791
Net revenues — current year	22,814	17,556
Prior years adjustments (Note 12)	32,653	2,522
Balance at end of year	278,336	222,869

*Deduction

"Notes to the financial statements"
are an integral part of this statement.

UNITED STATES OF AMERICA

COLUMBIA RIVER FEDERAL POWER SYSTEM

STATEMENT OF ASSETS AND LIABILITIES OF THE COMMERCIAL POWER PROGRAM AS OF JUNE 30, 1967, AND JUNE 30, 1966 (NOTES 1 AND 2)

(In thousands of dollars)

ASSETS

	June 30	
	1967	1966
FIXED ASSETS:		
Completed plant (Schedule A)	1,870,630	1,809,224
Retirement work in progress	2,916	2,945
	1,873,546	1,812,169
Less accumulated depreciation (Note 3)	185,011	206,359
	1,688,535	1,605,810
Construction work in progress (Schedule A)	676,987	489,755
Total flxed assets	2,365,522	2,095,565
CURRENT ASSETS:		
Unexpended funds	163,008	160,248
Special funds	1,314	1,323
Accounts receivable	16,872	15,846
Materials and supplies	8,738	6,447
Total current assets	189,932	183,864
DEFERRED CHARGE FOR PAYMENT OF IRRIGATION ASSISTANCE (Schedule A) (Note 6)	360,520	346,108
OTHER ASSETS AND DEFERRED CHARGES:		
Trust funds	894	845
Other assets and defered charges (Note 6)	4,606	2,182
Total other assets and deferred charges	5,500	3,027
TOTAL ASSETS	2,921,474	2,628,564

"Notes to the financial statements" are an integral part of this statement.

LIABILITIES

	June 30	
	1967	1966
INVESTMENT OF U.S. GOVERNMENT:		
Congressional appropriations	2,950,478	2,680,249
Revenues transferred to continuing fund	3,909	3,909
Transfers from other Federal agencies, net	20,173	21,671
Interest on Federal investment (Note 4)	583,831	534,098
Gross Federal investment	3,558,391	3,239,927
Less funds returned to U.S. Treasury	1,333,076	1,231,704
Net investment of U.S. Government	2,225,315	2,008,223
ACCUMULATED NET REVENUES:		
Balance at start of year	222,869	202,791
Net revenues current year (Exhibit 1)	22,814	17,556
Prior years adjustments (Note 12)	32,653	2,522
Balance at end of year	278,336	222,869
CURRENT LIABILITIES:		
Accounts payable	51,098	47,093
Employees accrued leave (Note 11)	3,452	3,143
Total current liabilities	54,550	50,236
LIABILITY OF U.S. GOVERNMENT FOR PAYMENT OF IRRIGATION ASSISTANCE (Schedule A) (Note 6)	360,520	346,108
OTHER LIABILITIES AND DEFERRED CREDITS:		
Trust fund advances	894	845
Other deferred credits (Note 6)	1,859	283
Total other liabilities and deferred credits	2,753	1,128
TOTAL LIABILITIES	2,921,474	2,628,564

EXHIBIT 3

UNITED STATES OF AMERICA

COLUMBIA RIVER FEDERAL POWER SYSTEM

STATEMENT OF SOURCE AND APPLICATION OF FUNDS OF COMMERCIAL POWER PROGRAM FOR FISCAL YEAR ENDING JUNE 30, 1967 (NOTES 1 AND 2)

(In thousands of dollars)

SOURCE OF FUNDS:		
Congressional appropriations	270,229	
Transfers from other Federal agencies	1,498*	
Gross investment		268,731
Revenues from sale of electrical energy	104,465	
Other operating revenue	8,363	
Total revenue		112,828
Total source of funds		381,559
APPLICATION OF FUNDS:		
Operation and maintenance expense (does not include current year's depreciation expense of 15,836, prior years' credit adjustment to depreciation expense of 32,794, and current year's interest expense of 35,326)		38,993
Investment in electric utility plant (does not include capitalized interest of 14,407)		238,592
Return of funds to U.S. Treasury for:		
Operation and maintenance expense	38,993	
Interest on Federal investment	35,326	
Repayment of capital investment	27,053	
Total funds returned to U.S. Treasury		101,372
Increase in current assets and liabilities, net		1,754
Increase in other assets and deferred charges, net of other liabilities and deferred credits (excluding irrigation assistance)		848
Total application of funds		381,559

*Deduction

"Notes to the financial statements" are an integral part of this statement.

Celilo Converter Station takes shape

UNITED STATES OF AMERICA

COLUMBIA RIVER FEDERAL POWER SYSTEM

AMOUNT AND ALLOCATION OF PLANT INVESTMENT
AS OF JUNE 30, 1967 (NOTES 2 AND 5)
PROJECTS IN SERVICE AND UNDER CONSTRUCTION

(In thousands of dollars)

Project	Total	COMMERCIAL POWER: Completed Plant (Notes 4, 5, 7 and 8)	COMMERCIAL POWER: Construction Work in Progress	COMMERCIAL POWER: Total	Returnable from Commercial Power Revenues	ALLOCATED TO: IRRIGATION: Returnable from Other Sources (Note 5)	IRRIGATION: Total Irrigation	NONREIMBURSABLE: Navigation	NONREIMBURSABLE: Flood Control	NONREIMBURSABLE: Fish and Wildlife	NONREIMBURSABLE: Recreation	NONREIMBURSABLE: Other	Percent of Total Returnable from Commercial Power Revenues
Projects in Service													
Transmission facilities (BPA)	778,397	640,524	137,873	778,397									100.0
Albeni Falls (CE)	32,457	31,896		31,896				134	173		254		98.3
Boise (BR)	65,475	4,810	26	4,836	11,143	34,550	45,693		14,946				24.4
Bonneville (CE)	89,391	61,229	107	61,336				28,007			48		68.6
Chief Joseph (CE)	156,021	155,592	315	155,907							114		99.9
Columbia Basin (BR)	584,952	170,558	5,275	175,833	297,588	64,601	362,189	1,000	45,390			540	80.9
Cougar (CE)	57,100	17,026	6	17,032		2,785	2,785	577	36,706				29.8
Detroit-Big Cliff (CE)	66,351	41,950	15	41,965		3,400	3,400	131	20,444			411	63.2
Green Peter-Foster (CE)	81,826	23,580	10,485	34,065		3,152	3,152	701	43,782		126		41.6
Hills Creek (CE)	48,719	14,016		14,016		4,987	4,987	623	29,093				28.8
Hungry Horse (BR)	102,144	77,405	68	77,473					24,671				75.8
Ice Harbor (CE)	137,843	93,417	557	93,974				43,066			803		68.2
Lookout Point-Dexter (CE)	94,232	41,916	9	41,925		5,070	5,070	853	46,305		79		44.5
McNary (CE)	303,902	256,526	53	256,579				46,889			434		84.4
Minidoka (BR)	36,288	1,861	44	1,905		34,061	34,061				28	294	5.2
Palisades (BR)	59,797	10,473	4	10,477	17,406	9,314	26,720		22,456		144		46.6
The Dalles (CE)	265,347	223,304	359	223,663				41,248			436		84.3
Yakima (BR)	63,810	4,547	6	4,553	9,501	48,604	58,105			1,152			22.0
Projects under Construction													
Dworshak (CE)	45,143		40,163	40,163				1,611	2,518		851		89.0
John Day (CE)	385,700		279,640	279,640				69,753	12,123		878	23,306[a]	72.5
Libby (CE)	43,485		33,857	33,857					9,628				77.9
Little Goose (CE)	76,865		52,372	52,372				24,457			36		68.1
Lost Creek (CE)	1,240		497	497		81	81		229	281	109	43	40.1
Lower Granite (CE)	19,647		15,150	15,150				4,478			19		77.1
Lower Monumental (CE)	132,982		100,106	100,106				32,876					75.3
Irrigation assistance at 12 projects having no power generation	24,022				24,022		24,022						100.0
Subtotal plant investment	3,753,136	1,870,630	676,987	2,547,617	359,660	210,605	570,265	296,404	308,464	1,433	4,359	24,594	77.5
Repayment obligation retained by Columbia Basin Project (Note 6)	2,212	1,352		1,352	860		860						100.0
Total	3,755,348	1,871,982	676,987	2,548,969	360,520	210,605	571,125	296,404	308,464	1,433	4,359	24,594	77.5

BPA—Bonneville Power Administration
CE—Corps of Engineers Project
BR—Bureau of Reclamation Project
[a]Non-reimbursable road costs
"Notes to the financial statements" are an integral part of this statement.

UNITED STATES OF AMERICA
COLUMBIA RIVER FEDERAL POWER SYSTEM
NOTES TO THE FINANCIAL STATEMENTS

Note 1. Basis of Financial Reporting

The accompanying financial statements for the Columbia River Federal Power System are prepared on the cost accounting basis which includes depreciation by the compound interest method as one element of cost. The statements do not show financial results on a repayment basis either for the fiscal year or cumulatively.

The average depreciation life of the fixed assets allocated to power is about 84 years for the generating projects and 46 years for the transmission system. The average composite life for the entire system is about 65 years. A separate repayment analysis is prepared for the system based upon repayment periods of 50 years for the generating projects and 45 years for the transmission system. As a result of the difference between depreciation and repayment periods, depreciation charges accumulated during the repayment periods are much less than repayment requirements for the same periods. Wholesale power rates are based upon the repayment analysis rather than on these cost based statements.

Note 2. Composition of the Columbia River Federal Power System

The Columbia River Federal Power System (CRFPS) is the name applied to the hydroelectric generating plants constructed and operated by the Corps of Engineers (Corps) and the Bureau of Reclamation (Bureau), and the Bonneville Power Administration (BPA) transmission facilities. BPA is the power marketing agent for the system.

The CRFPS is neither an official government agency, nor is it an individual legal entity. BPA, the Corps and the Bureau are separate agencies, each separately managed and financed and each having a separate accounting system. However, the generating plants and transmission facilities are operated as an integrated power system, and the financial statements showing the results of power operations are consolidated and prepared on the same basis, under the name of the Columbia River Federal Power System.

The projects in service and under construction at June 30, 1967, are listed in Schedule A.

Note 3. Depreciation

All of the entities of the CRFPS now use the compound interest method of depreciation. The method was officially adopted by BPA in fiscal year 1963, by the Bureau in fiscal year 1965, and by the Corps late in fiscal year 1966. The fiscal year 1966 adjustment by the Corps for conversion to the compound interest method of depreciation was not considered final since the Corps used shortcut procedures to determine accumulated depreciation under the new method. During fiscal year 1967, the Corps made final adjustments using approved procedures.

During fiscal year 1967, BPA and the Corps revised the estimated depreciation lives for the transmission and generating facilities. Based on a comprehensive study of depreciation factors, BPA extended the average composite depreciation life of its facilities from 38 to 45 years, effective July 1, 1966. The Corps developed revised composite service lives for each project at the feature or subfeature plant account level using uniform service lives which have been prescribed for each plant unit or applicable component. The average composite service life of 64 years for Corps projects was extended to 85 years which is more in line with the 81 year average composite service life for Bureau projects.

The final adjustment for conversion to the compound interest method of depreciation, together with the use of revised service lives for Corps projects, resulted in a decrease of about $32,800,000 to accumulated depreciation from the start of operations to June 30, 1966. Use of extended service lives reduced fiscal year 1967 depreciation charges for Corps projects approximately $3,700,000 and for the BPA transmission system approximately $2,300,000.

Note 4. Interest

The interest rates applicable to the unpaid Federal investment for Corps and Bureau generating projects and the annual increments of BPA transmission investment at June 30, 1967, are as follows:

Bureau Projects

In Service		Under Construction	
Boise	3%	Grand Coulee Third Powerplant	3⅛%
Columbia Basin	3		
Hungry Horse	3		
Minidoka	3		
Palisades	3		
Yakima-Roza Div.	3		
Yakima-Kennewick Div.	2½		

Corps Projects

In Service		Under Construction	
Albeni Falls	2½%	Dworshak	2⅝%
Bonneville	2½	John Day	2½
Chief Joseph	2½	Libby	3⅛
Cougar	2½	Little Goose	2½
Detroit-Big Cliff	2½	Lost Creek	3⅛
Green Peter-Foster	2½	Lower Granite	2½
Hills Creek	2½	Lower Monumental	2½
Ice Harbor	2½		
Lookout Point-Dexter	2½		
McNary	2½		
The Dalles	2½		

Bonneville Power Administration

Included in investment in fiscal year 1963 and prior	2½%
Included in investment in fiscal year 1964	2⅞
Included in investment in fiscal year 1965	3
Included in investment in fiscal year 1966 and 1967	3⅛

Authority for Rates Used

The 3% interest rate shown above for Bureau projects was established by the Bureau pursuant to Section 9 (c) of the Reclamation Project Act of 1939 (43 U.S.C. 485 h (c)). The 2½% interest rate for the Kennewick Division of the Yakima Project was established pursuant to Section 3 of the Act of June 12, 1948, (62 Stat. 382) which authorized construction of that division. Authorizing legislation for the Grand Coulee Third Powerplant required the use of an interest rate determined by the Secretary of the Treasury as of the beginning of the fiscal year in which the initial request for appropriations was made. Accordingly, the rate established in fiscal year 1967 was 3⅛%.

Interest rates applicable to the Corps generating projects and the BPA transmission system are not stipulated by law. Thus, interest rates have been determined based on administrative policies in effect at the time the facilities were constructed. Currently, both the Corps and BPA apply interest rates determined by the Treasury Department pursuant to Senate Document 97, 87th Congress which contains an interest rate formula for planning water resource projects.

On the Lower Snake River where Corps projects were authorized as units of a navigation system, the same interest rate has applied to all projects in the group regardless of when construction started. Thus, the 2½% rate initially established for the Ice Harbor Project has been applied to the Little Goose, Lower Granite, and Lower Monumental Projects.

Composition of Net Federal Investment

Both the Corps and BPA calculate current year interest expense on a base which includes all elements of the net Federal investment in the commercial power program including plant investment, working capital, and operation and maintenance expenditures. However, the Bureau's interest base has been established according to its interpretation of Federal reclamation law. Accordingly, the Bureau's interest base has not included (1) interest during the construction period for four projects and one division of a fifth project, (2) plant costs allocated to river regulation resulting from the Columbia Basin Project, prior to fiscal year 1963, and (3) other items such as investments in working capital. Had the Bureau computed annual interest expense for the Columbia Basin and Hungry Horse Projects, at a rate of 2½%, on an interest base consistent with that of the Corps and BPA, accumulated net revenues at June 30, 1967, would be reduced about $19,300,000. The corresponding effect for the other Bureau projects would be minor by comparison.

BPA and the Corps capitalize interest during the construction period and have done so for all projects in the system. Although the Bureau's current policy is to capitalize interest during construction, in some cases prior to 1956, project authorizing legislation did not require capitalization of such interest. Accordingly, interest during construction was not included at the Boise, Columbia Basin, Hungry Horse, and Minidoka Projects, or the Kennewick Division of the Yakima Project. Had the Bureau capitalized interest during the construction period consistent with the Corps and BPA, total capitalized plant for the Columbia Basin and Hungry Horse Projects would be increased by about $12,700,000 at June 30, 1967. Unrecorded cumulative compound interest depreciation on this amount through June 30, 1967, is about $900,000. Interest during construction excluded for the other Bureau projects is minor in comparison.

Note 5. Cost Allocations

Costs of facilities which serve only one purpose are assigned to that purpose. For projects which serve more than one purpose, (e.g., power, irrigation, navigation, and flood control), it is necessary to allocate the costs of joint-use facilities among the purposes served. The term "cost allocation" is used to describe this process and result.

Cost allocations of joint-use facilities are designated as firm or tentative. A tentative allocation is one which may be adjusted retroactively when it is made firm. A firm allocation may be changed in the future, if conditions warrant, but only prospectively. The following table shows the status of cost allocations for the generating projects at June 30, 1967.

Status of Cost Allocations

Project	Status
Albeni Falls	Firm
Boise	Firm
Bonneville Dam	Firm
Chief Joseph	Tentative
Columbia Basin	Firm
Cougar	Tentative
Detroit - Big Cliff	Tentative
Green Peter - Foster	Tentative
Hills Creek	Tentative
Hungry Horse	Firm
Ice Harbor	Firm
Lookout Point - Dexter	Tentative
McNary	Firm
Minidoka	Firm
Palisades	Tentative
The Dalles	Tentative
Yakima	Firm

The North Pacific Division of the Corps of Engineers has developed proposed firm allocations for The Dalles and Hills Creek Projects. The proposed allocations have been transmitted by the North Pacific Division to the Corps' office in Washington, D.C., where they are being considered by an interagency group consisting of representatives from the Corps of Engineers, the Department of the Interior, and the Federal Power Commission.

The proposed firm allocation for the Hills Creek Project results in 24.5% of joint construction costs being allocated to power as compared wiith the tentative allocation used in these statements of 16.5%. For The Dalles Project, the proposed firm allocation results in 74% of joint construction costs being allocated to power as compared with 74.5% in the tentative allocation.

Joint project costs of $19,395,000 for the Cougar, Detroit-Big Cliff, Hills Creek, Lookout Point-Dexter, and the Green Peter-Foster Projects have been allocated to irrigation pursuant to project authorizations. Determination of water users' repayment ability will be made at the time the irrigation facilities are proposed for authorization and development. If water users' repayment ability is insufficient to meet the repayment requirements, irrigation assistance may be required from power revenues. Such assistance must be authorized by Congress.

Note 6. Additional Repayment Responsibility

In addition to the repayment responsibility referred to in Note 1 above, the CRFPS is also required to repay to the United States Treasury from its power revenues the cost of irrigation facilities which

benefiting water users are unable to repay. At June 30, 1967, the amount required to provide this assistance was $360.5 million. Repayment of this obligation is scheduled to commence in 1997.

During fiscal year 1967, migratory fish facilities constructed in conjunction with the Columbia Basin Project at a recorded cost of $3,136,000 were transferred to the Bureau of Sport Fisheries and Wildlife. However, a total of $2,212,000 of this cost is to be returned from power revenues. About $860,000 of the $2,212,000 is allocated to irrigation and is included in both the Deferred Charge and the Liability of U.S. Government for Payment of Irrigation Assistance. The balance of $1,352,-000 is allocated to power and is included in Other Assets and Deferred Charges and in Other Liabilities and Deferred Credits. (See Exhibit 2 and Schedule A.)

Note 7. Costs Incurred by Other Agencies

BPA, the Bureau, and the Corps currently do not include in their accounts the estimated cost of space rental and audit services furnished by other Federal agencies. However, costs incurred by other agencies were included in BPA accounts through fiscal 1962. BPA changed its policy beginning with fiscal year 1963 in order to conform with other power agencies of the Department of the Interior. The decision was made pending clarification of accounting policy for the items.

The total value of space furnished to BPA by the General Services Administration during fiscal year 1967 and not included in the financial data for fiscal year 1967 was approximately $743,000. Of this amount $312,000 was applicable to operating expenses, and $431,000 was applicable to plant investment.

Estimated costs of services furnished by other Federal agencies to the Bureau and the Corps are considered to be minor in comparison.

Audit services furnished to CRFPS during fiscal year 1967 by the General Accounting Office and not included in the financial data are estimated at $100,000, all applicable to operating expenses.

Note 8. Preliminary Survey and Investigation Costs

The Bureau's policy is to capitalize all pre-authorization general investigations costs which relate to a project in a form authorized by Congress. However, the policy of the Corps is to exclude all preliminary survey and investigation costs which are incurred prior to project authorization. The Corps implemented this policy in fiscal year 1964 and deleted $1,913,000 of such costs from project plant accounts. These costs were deleted upon instructions from the Office of the Chief of Engineers to permit consistency with Senate Document 97, 87th Congress, which defines project installation costs. The Corps interprets this document as limiting the inclusion of preliminary survey and investigation costs to those which occur after project authorization.

Note 9. Hanford NPR Steam Plant

The 860,000 kilowatt Hanford Steam Plant, constructed by the Washington Public Power Supply System (WPPSS) was certified as ready for normal continuous operations on November 29, 1966. The plant generates electric power by using by-product steam energy from the manufacture of plutonium in the Atomic Energy Commission's New Production Reactor (NPR).

Under Exchange Agreements between BPA, WPPSS and 76 utility participants, WPPSS will furnish to BPA the total electric power generated by the steam plant. In return, BPA will furnish an amount of power equal in value at BPA rates to the participant's share of the project's Annual Operating Budget. The WPPSS budget for the year ending August 31, 1967, was about $9,420,000, of which about $7,850,000 was applicable to the 10-month period ending June 30, 1967. The agreements call for payment to WPPSS by each participant for its share of the costs of the project based on the Annual Operating Budget. Credits in like amounts are allowed on BPA's power bills to each participant. The power bills are recorded on BPA's books as revenue on a gross basis, and the credits are recorded as expenses of power purchased.

Construction of the plant was financed by WPPSS using the proceeds of a bond issue of 1963. As of October 1967, about $100,000,000 has been invested in the plant or established as reserves in accordance with the bond resolution.

If the plant becomes inoperable during the bond repayment period ending 1996, BPA will be required to provide electric energy and capacity to the participants in an amount equal in value to the total charges of the project, including all payments required under the bond resolution. The Government has the option to acquire ownership of the plant subject to Congressional approval. If the option is exercised after 1996, the Government may acquire ownership at no cost and assume the project's assets and liabilities.

The end of the Hanford bond repayment period, 1996, is also the end of the estimated useful life for depreciation purposes. BPA engineers have estimated that the probable value of the plant in 1996 will be its salvage value, based on the assumption that the Atomic Energy Commission's New Production Reactor will not be manufacturing plutonium at that time.

Note 10. Contingent Liabilities Not Included in the Statements

Contingent liabilities of the CRFPS at June 30, 1967, allocable to power total $18,300,000; $10,400,000 representing claims under the Federal Tort Claims Act and $7,900,000 representing various contractor claims. Included among the tort items is a $9,700,000 claim against the Bonneville Dam by the Yakima Tribe of Indians.

Note 11. Estimated Liability for Accrued Annual Leave

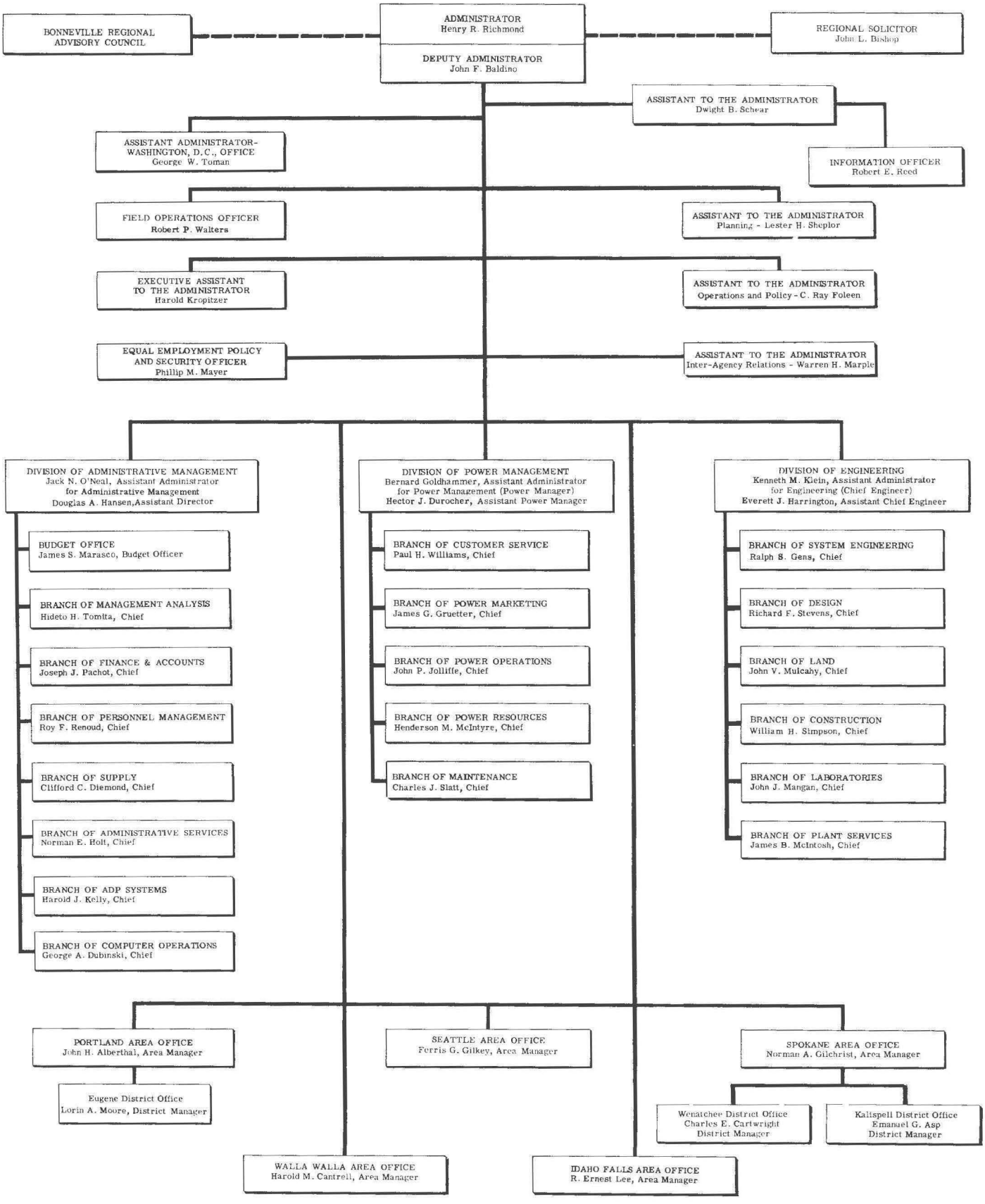
The amount of the liability for accrued annual leave applicable to BPA is included in Employees' Accrued Leave. The liability for Corps projects has been transferred, along with project funds to cover the liability, to a Corps revolving fund which is not included in the CRFPS financial statements.

The official accounts for the Bureau projects in this region do not include an amount for the value of accrued annual leave at June 30, 1967. The amount of the liability applicable to commercial power and not included in the accompanying statements is estimated at $516,000.

Note 12. Adjustments to Accumulated Net Revenues

The following table explains the adjustments which have caused the net increase in Accumulated Net Revenues of $32,653,000 shown on Exhibits 1 and 2:

	Thousands of Dollars
a. Reduction of accumulated depreciation for Corps projects resulting from the adoption of longer service lives and revision of the fiscal year 1966 adjustment for adoption of the compound interest method of depreciation applied from the start of operations to June 30, 1966.	32,827
b. Write-off of power revenues billed by BPA prior to July 1, 1966, determined during F. Y. 1967 by the Justice Department to be uncollectible.	(325)
c. Reduction of prior years' interest expense for the Boise Project based on a reapplication of net power revenues from irrigation aid to power investment.	204
d. Miscellaneous minor adjustments	(53)
TOTAL	32,653



December 31, 1967

BPA Associated & Management Groups

PACIFIC NORTHWEST FIELD COMMITTEE

JOE D. DWYER, Regional Coordinator
Department of the Interior, Portland, Oregon

H. R. RICHMOND, Administrator
Bonneville Power Administration, Portland, Oregon

DONALD R. JOHNSON, Regional Director
Bureau of Commercial Fisheries, Seattle, Washington

DALE M. BALDWIN, Area Director
Bureau of Indian Affairs, Portland, Oregon

EUGENE K. PETERSON, Chief
Division of Economics and Basin Studies, PSC
Bureau of Land Management, Portland, Oregon

MARK L. WRIGHT, Area Director, Area VII
Bureau of Mines, Albany, Oregon

FRED J. OVERLY, Regional Director
Bureau of Outdoor Recreation, Seattle, Washington

HAROLD T. NELSON, Regional Director
Bureau of Reclamation, Boise, Idaho

JOHN D. FINDLAY, Regional Director
Bureau of Sport Fisheries and Wildlife, Portland, Oregon

RICHARD F. POSTON, Regional Director
Federal Water Pollution Control Admin., Portland, Oregon

WALTER HOFFMAN, Regional Hydrologist
Geological Survey, Menlo Park, California

JOHN A. RUTTER, Regional Director
National Park Service, San Francisco, California

BONNEVILLE REGIONAL ADVISORY COUNCIL

Portland Area

Mr. George M. Baldwin
General Manager
The Port of Portland
Post Office Box 3529
Portland, Oregon 97208

Colonel Roy F. Bessey
Water Resources Consultant
606 Southwest Evans Street
Portland, Oregon 97219

Mr. Philip N. Bladine
Publisher
The News-Register
McMinnville, Oregon 97128

Mr. Ivan Bloch
Industrial and Economic Consultant
220 Southwest Alder Street
Portland, Oregon 97204

Mr. J. Milton Brown
Executive Secretary
Central Labor Council AFL-CIO of
Clark, Skamania and West Klickitat Counties
9312 N.W. Starkrest Avenue
Vancouver, Washington 98665

Mr. A. M. Burdge
Resident Vice President
Nationwide Mutual Insurance Company
Post Office Box 2244
Portland, Oregon 97214

Mr. W. E. Campbell
Plant Manager
Reynolds Metals Company
Troutdale, Oregon 97060

Dr. David B. Charlton
Charlton Laboratories, Inc.
Post Office Box 1048
Portland, Oregon 97207

Mr. Charles S. Collins
Coordinator
Douglas County Natural Resources
Douglas County Courthouse
Roseburg, Oregon 97470

Mr. John D. Davis
Davis-Bell Insurance Agency
Stayton, Oregon 97383

Dr. Arthur S. Flemming
President
University of Oregon
Eugene, Oregon 97403

Mr. O. G. Hittle
General Manager
Cowlitz County PUD
960 Commerce
Longview, Washington 98632

Mr. Charles W. Hodde
Chairman
Pacific Northwest River Basins Commission
110 East 13th Street
Vancouver, Washington 98660

Mr. James C. Howland
General Manager
Cornell, Howland, Hayes & Merryfield
1600 Western Avenue
Corvallis, Oregon 97330

Mr. Alan H. Jones
General Manager
Water and Light Department
City of McMinnville
130 North Baker Street
McMinnville, Oregon 97128

Dr. James H. Jensen
President
Oregon State University
Corvallis, Oregon 97331

Mr. William C. Klein
Attorney
601 East McLoughlin Boulevard
Vancouver, Washington 98663

Mr. Ivan C. Laird
Member Board of Directors
Coos-Curry Electric Cooperative, Inc.
Post Office Box 460
Coquille, Oregon 97423

Mr. Donel J. Lane
Executive Secretary
State Water Resources Board
500 Public Service Building
Salem, Oregon 97310

Mr. James J. Leary
Director
Region 21 AFL-CIO
404 Woodlark Building
Portland, Oregon 97205

Mr. Herbert Lundy
Editor of the Editorial Page
The Oregonian
1320 S.W. Broadway
Portland, Oregon 97201

Mr. James T. Marr
4006 S.E. Crystal Springs Boulevard
Portland, Oregon 97202

Mr. Eugene E. Marsh
Attorney
525 East Fourth Street
McMinnville, Oregon 97128

Mr. Shirley R. Marsh
Attorney
960 Commerce Avenue
Longview, Washington 98632

Mr. J. M. McClelland, Jr.
Editor and Publisher
Longview Daily News
Longview, Washington 98632

Dr. Charles McKinley
Political Scientist
7001 Southeast 35th Avenue
Portland, Oregon 97202

Mr. Andrew J. Naterlin
Member Oregon State Legislature
712 Alder Street
Newport, Oregon 97365

Mr. James Nichols
Tolovana Park, Oregon 97145
Dr. William A. Pearl
2166 Northeast Tillamook Street
Portland, Oregon 97212

Mr. Gus Norwood
Executive Secretary
Northwest Public Power Association
113 West First Street
Vancouver, Washington 98660

Mr. W. A. Paul
Director of Utilities
State of Oregon
Salem, Oregon 97310

Dr. William A. Pearl
2166 Northeast Tillamook Street
Portland, Oregon 97212

Dr. Wallace A. Pratt
2705 Southeast River Road
Portland, Oregon 97222

Mr. Eric A. Reutercrona
Executive Secretary
Oregon Rural Electric
Cooperatives Assocation
Post Office Box 460
Coquille, Oregon 97423

Mr. Joe S. Rosenzweig
Martin Insurance, Inc.
Post Office Box 456
Longview, Washington 98632

Mr. Lew S. Russell
President
Tidewater Barge Lines
2609 N.E. Marine Drive
Portland, Oregon 97211

Mr. Kenneth F. Rystrom
Editor of the Editorial Page
The Columbian
701 West 8th Street
Vancouver, Washington 98660

Mr. W. C. Schwenn
Attorney
139 East Lincoln
Hillsboro, Oregon 97123

Mr. Donald J. Sterling, Jr.
Editor of the Editorial Page
Oregon Journal
1320 Southwest Broadway
Portland, Oregon 97201

Mr. Thomas W. Stewart
President
Columbia Power Trades Council
3645 Southeast 32nd Avenue
Portland, Oregon 97202

Mr. Donald H. Tilson
Industrial Consultant
Port of Vancouver
Post Office Box 570
Vancouver, Washington 98660

Mr. Preston B. Varney
Industrial Development Consultant
2510 Ocean Beach
Longview, Washington 98632

Mr. Frank M. Warren
President
Portland General Electric Company
621 S.W. Alder Street
Portland, Oregon 97205

Mr. George W. Watters
Manager
Public Utility District of Clark County
Post Office Box 1626
Vancouver, Washington 98663

Mr. Allen P. Wheeler
Master
Oregon State Grange
1313 S.E. 12th Avenue
Portland, Oregon 97214

Mr. Edward Whelan
Executive President
Oregon AFL-CIO
105 High Street, Southeast
Salem, Oregon 97301

Mr. Robert H. Wooden
Executive Secretary
Columbia Power Trades Council
4523 Southeast Concord Road
Milwaukie, Oregon 97222

BONNEVILLE REGIONAL ADVISORY COUNCIL

Seattle Area

Mr. Maurice Ahlquist
Director
Washington Department of Conservation
335 General Administration Building
Olympia, Washington 98502

Mr. Paul J. Alexander
City Councilman
1106 Seattle Municipal Building
600 Fourth Avenue
Seattle, Washington 98104

Mr. Fred Arpke
Economic Consultant
Post Office Box 164
Medina, Washington 98039

Mr. A. G. Ash
Development Manager
Hooker Chemical Corporation
Post Office Box 1646
Tacoma, Washington 98401

Mr. Miner H. Baker
Vice President and Economist
Seattle-First National Bank
Post Office Box 3586
Seattle, Washington 98124

Mr. Ken Billington
Executive Secretary
Washington Public Utility
Districts' Association
601 Tower Building
Seattle, Washington 98101

Mr. John D. Bixby, MS 13-82
Director of Facilities
The Boeing Company
Post Office Box 3707
Seattle, Washington 98124

Mr. George Buck
General Manager
Port Angeles Evening News
120 South Lincoln
Port Angles, Washington 98362

Mr. A. B. Comfort
Attorney
819 South "K" Street
Tacoma, Washington 98405

Mr. Dan Coughlin
Financial Editor
Seattle Post-Intelligencer
Post Office Box 1909
Seattle, Washington 98111

Mr. Joe Davis
President
Washington State Labor Council
AFL-CIO
2700 First Avenue
Seattle, Washington 98121

Mr. F. W. Durnan
Attorney
Post Office Box 631
Lynden, Washington 98264

Mr. C. A. Erdahl
Director of Utilities
City of Tacoma
Post Office Box 11007
Tacoma, Washington 98411

Mr. L. J. Forrest
Vice President
Rayonier, Incorporated
Post Office Box 539
Hoquiam, Washington 98550

Mr. C. Henry Heckendorn
Attorney
814 Second Avenue
Seattle, Washington 98104

Mr. William F. Johnston
Publisher of Student Publications
University of Washington
144 Communications Building
Seattle, Washington 98105

Mr. Lawrence E. Karrer
Senior Vice President
Puget Sound Power & Light Company
Puget Power Building
Bellevue, Washington 98004

Mr Henry W. Loren
Member Public Utility Board
Tacoma City Light
2719 North 29th Street
Tacoma, Washington 98407

Mr. Sidney S. McIntyre
President
Skagit Corporation
Post Office Box 151
Sedro-Woolley, Washington 98284

Mr. Robert E. Means
Manager—Engineering, West
Hooker Chemical Corporation
Post Office Box 1646
Tacoma, Washington 98401

Mr. A. Lars Nelson
Master
Washington State Grange
3104 Western Avenue
Seattle, Washington 98121

Mr. John M. Nelson
Superintendent of Lighting
City of Seattle
1015 Third Avenue
Seattle, Washington 98104

Mr. Francis Pearson
Commissioner
Washington Utilities
& Transportation Commission
Insurance Building
Olympia, Washington 98501

Mr. W. Ronald Richardson
Resident Manager
Crown Zellerbach Corporation
719 White-Henry-Stuart Building
Seattle, Washington 98101

Mr. Edwin W. Taylor
President Board of Commissioners
Mason County PUD No. 3
Route 1, Box 124
Shelton, Washington 98584

Mr. Robert I. Thieme
Vice President and General Manager
Scott Paper Company
West Coast Division
Everett, Washington 98201

Mr. H. S. Thomson
Business Manager
University of Washington
206 Administration Building
Seattle, Washington 98105

Mr. Gerrit Vander Ende
President
Pacific First Federal
Savings and Loan Association
11th and Pacific Avenue
Tacoma, Washington 98401

Mr. Harold Walsh
Walsh-Platt Motors
2902 Rucker
Everett, Washington 98201

Mr. Stewart H. White
Electrical Engineer
Weyerhaeuser Company
1015 "A" Street
Tacoma, Washington 98401

Dr. H. F. Yancey
Coal Consultant
18321 Ridgefield Road, N.W.
Seattle, Washington 98177

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Lewiston, Idaho 83501

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Newscaster
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Ellensburg, Washington 98926

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Sandpoint, Idaho 83864

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Industrial Development Council
Post Office Box 329
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Spokane, Washington 99210

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Cle Elum, Washington 98922

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Montana AFL-CIO
Box 96, Crescent Drive
Columbia Falls, Montana 59912

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1010 Old National Bank Building
Spokane, Washington 99201

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Attorney
763 Lincoln Building
Spokane, Washington 99201

Dr. William A. Dittmer
Power Consultant
Kaiser Aluminum & Chemical Corporation
305 Spokane & Eastern Building
Spokane, Washington 99201

Mr. Howard C. Elmore
Assistant Manager
Chelan County PUD
Post Office Box 1231
Wenatchee, Washington 98801

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Rancher
Choteau, Montana 59422

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Director
Clearwater Power Company
Post Office Box 624
Lewiston, Idaho 83501

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Field Secretary
Washington State
Columbia Basin Commission
Post Office Box 146
Ephrata, Washington 98823

Mr. Paul K. Harlow
Rancher
Post Office Box 277
Thompson Falls, Montana 59873

Mr. Leonard F. Jansen
Attorney
North 711 Lincoln Street
Spokane, Washington 99201

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Dean
College of Engineering
University of Idaho
Moscow, Idaho 83843

Mr. Norman L. Krey
Manager Northwest Operations
Kaiser Aluminum & Chemical Corporation
305 Spokane & Eastern Building
Spokane, Washington 99201

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Copublisher and Business Manager
Columbia Basin Daily Herald
805 West Third
Moses Lake, Washington 98837

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Rancher
Charlo, Montana 59824

Mr. R. E. Mansfield
Attorney
Lane Building
Okanogan, Washington 98840

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Manager
Spokane Chamber of Commerce
West 1020 Riverside Avenue
Spokane, Washington 99201

Mr. Callison Marks
Chief Editorial Writer
The Spokesman-Review
927 Riverside Avenue
Spokane, Washington 99201

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President
Columbia Plateau Resources Council
Route 2
Plummer, Idaho 83851

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Port of Lewiston
513 Main Street
Lewiston, Idaho 83501

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The Montana Power Company
Post Office Box 1338
Butte, Montana 59701

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Missoulian
Missoula, Montana 59801

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University of Montana
Missoula, Montana 59801

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Bovay Engineers
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Spokane, Washington 99201

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Washington Water Research Center
Washington State University
Pullman, Washington 99163

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Post Office Box 1204
Ephrata, Washington 98823

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Conner, Montana 59821

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The Wenatchee Daily World
Post Office Box 1511
Wenatchee, Washington 98801

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244 Sonna Building
Boise, Idaho 83702

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Afton, Wyoming 83110

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Cranney Chevrolet Company
160 South State Street
Preston, Idaho 83263

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2700 Edson Street
Boise, Idhao 83705

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Malad City, Idaho 83252

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Rigby, Idaho 83442

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Rancher
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Boise, Idaho 83704

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Idaho State University
Pocatello, Idaho 83201

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President
Idaho State AFL-CIO
Post Office Box 269
Boise, Idaho 83701

Mr. W. Anthony Park
Attorney
1365 North Orchard
Boise, Idaho 83704

Honorable S. E. Pedersen
Mayor, City of Idaho Falls
Post Office Box 220
Idaho Falls, Idaho 83401

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Resident Manager
Inorganic Chemicals Division
FMC Corporation
Post Office Box 4111
Pocatello, Idaho 83201

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Rogers Brothers Company
Post Office Box 2188
Idaho Falls, Idaho 83401

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Box 617
Malta, Idaho 83342

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Associate Editor
Intermountain-Observer
Post Office Box 7337
Boise, Idaho 83707

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Walla Walla Area

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Director
Battelle Northwest
Post Office Box 999
Richland, Washington 99352

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Yakima, Washington 98901

Mr. Byron C. Brinton
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Baker, Oregon 97814

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Rancher
RFD No. 3
Walla Walla, Washington 99362

Mr. Joe F. Caraher
Publisher-Editor
Herald and News
Post Office Box 788
Klamath Falls, Oregon 97601

Mr. Lee E. Darland
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Klickitat County PUD
219 West "C" Street
Goldendale, Washington 98620

Mr. Benjamin B. Flathers
Rancher
Star Route
Prescott, Washington 99348

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Editor and Publisher
The East Oregonian
Pendleton, Oregon 97801

Mr. Burton A. Hall
1120 Sheridan Avenue
Prosser, Washington 99350

Mr. Glenn C. Lee
Publisher
Tri-City Herald
Post Office Box 2608
Tri-Cities, Washington 99302

Mr. Charles F. Luce
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4 Irving Place
New York, New York 10003

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Member Washington State Legislature
1314 Hains
Richland, Washington 99352

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Columbia Rural Electric Association
Waitsburg, Washington 99361

Mr. Ben Musa
Member Oregon State Legislature
Post Office Box 458
The Dalles, Oregon 97058

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Rancher
Fort Rock, Oregon 97735

Mr. Oscar E. Peterson
Box No. 25
Ione, Oregon 97843

Mr. William D. Ray
President
Melcher-Ray Machinery Company
1014 South Ninth Street
Walla Walla, Washington 99362

Mr. S. M. Rhyneer
Chief, General Engineering Branch
Atomic Energy Commission
Post Office Box 550
Richland, Washington 99352

Mr. E. O. Thoman
Washington Division Manager
Pacific Power & Light Company
Post Office Box 1288
Yakima, Washington 98901

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Member Board of Directors
Harney Electric Cooperative
Buchanan Route
Burns, Oregon 97720

Mr. Glenn C. Walkley
President
Franklin County PUD
Post Office Box 2407
Pasco, Washington 99301

Mr. Robert Welty
Consulting Engineer
Post Office Box 377
The Dalles, Oregon 97058

Mr. Herbert G. West
Executive Vice President
Inland Empire Waterways Association
Post Office Box 1098
Walla Walla, Washington 99362

Mr. R. L. Woolley
Manager
Umatilla Electric
Cooperative Association
Post Office Box 1025
Hermiston, Oregon 97838

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As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States – now and in the future.

U.S. DEPARTMENT OF THE INTERIOR
March 3, 1849