

GAO

Report to the Chairman, Subcommittee
on Water and Power, Committee on
Resources, House of Representatives

March 1999

FEDERAL POWER

Implications of Reduced Maintenance and Repairs of Federal Hydropower Plants





**United States
General Accounting Office
Washington, D.C. 20548**

**Resources, Community, and
Economic Development Division**

B-282016

March 30, 1999

The Honorable John T. Doolittle
Chairman, Subcommittee on Water
and Power Committee on Resources
House of Representatives

Dear Mr. Chairman:

This report discusses the reliability of the Bureau of Reclamation's and the Corps of Engineers' hydropower plants in generating electricity compared with the reliability of nonfederal hydropower plants, reasons why the Bureau's and the Corps' plants may be less reliable than nonfederal plants and the potential implications of reduced reliability, and the actions taken to obtain funding to better maintain and repair the Bureau's and the Corps' plants.

As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies of the report to Representative Don Young, Chairman, House Committee on Resources; Representative George Miller, Senior Democratic Member, House Committee on Resources; Representative Calvin Dooley, Ranking Minority Member, House Committee on Resources, Subcommittee on Water and Power; Senator Frank Murkowski, Chairman, Senate Committee on Energy and Natural Resources; Senator Jeff Bingaman, Ranking Minority Member, Senate Committee on Energy and Natural Resources; Senator John Chafee, Chairman, Senate Committee on Environment and Public Works; and Senator Max Baucus, Ranking Minority Member, Senate Committee on Environment and Public Works. We are also sending the report to Charles Borchardt, Administrator, Southeastern Power Administration; Michael Deihl, Administrator, Southwestern Power Administration; Major General Russell Fuhrman, Director, Civil Works, U.S. Army Corps of Engineers; Michael Hacskeylo, Administrator, Western Area Power Administration; Judi Johanson, Administrator, Bonneville Power Administration; and Eluid Martinez, Commissioner, Bureau of Reclamation. We will make copies available to others upon request.

If you or your staff have any questions, please call me on (202) 512-3841. Major contributors to this report are listed in appendix VI.

Sincerely yours,

A handwritten signature in black ink that reads "Susan D. Kladiva". The signature is written in a cursive style with a large initial 'S' and a distinct 'K'.

Susan D. Kladiva,
Associate Director, Energy,
Resources, and Science Issues

Executive Summary

Purpose

Because of new, more efficient technologies for generating electricity and emerging competition in restructured electricity markets, electricity rates have decreased by about 25 percent since 1982 and are expected to continue to decrease.¹ Electricity provided by the federal government from hydropower plants is generally priced less than other electricity and is very marketable;² however, to retain this competitiveness as markets continue to restructure, the federal hydropower plants³ need to be operated as reliably as nonfederal hydropower plants. Reliable operation will help to ensure that the government can continue to market the electricity it generates and recover its outstanding appropriated and other debt of about \$22 billion.⁴ In addition, the Congress, GAO, and the Office of Management and Budget have been working to help ensure that the purchase and maintenance of all assets and infrastructure have the highest and most efficient returns to the taxpayer and the government. The agencies that generate most of this electricity—the Army Corps of Engineers (the Corps), the Department of the Interior’s Bureau of Reclamation (the Bureau)—and the federal agencies that sell it—the Department of Energy’s four power marketing administrations (PMA)⁵—need to be able to adequately maintain the federal hydropower plants and transmission systems, in order to provide a reliable supply of electricity.

As requested by the Chairman, Subcommittee on Water and Power, House Committee on Resources, GAO examined (1) the reliability of the Bureau’s and Corps’ hydropower plants in generating electricity compared with the reliability of nonfederal hydropower plants,⁶ (2) reasons why the Bureau’s and the Corps’ plants may be less reliable than nonfederal plants and the potential implications of reduced reliability, and (3) the actions taken to

¹The 25-percent reduction is calculated in terms of constant dollars.

²See *Federal Power: Options for Selected Power Marketing Administrations’ Role in a Changing Electricity Industry* (GAO/RCED-98-43, Mar. 6, 1998).

³A power plant includes one or more generating units that produce electricity.

⁴We use the term “appropriated debt” because the PMAs are required to set their electricity rates to generate revenue at levels that will recover appropriations used for capital investments by the Bureau and the Corps. However, these reimbursable appropriations are not considered to be lending by the Department of the Treasury. Other debt includes primarily debt for irrigation facilities and other debt for certain nonfederal nuclear power plants.

⁵The four power marketing administrations are the Bonneville Power Administration (Bonneville), Southeastern Power Administration (Southeastern), Southwestern Power Administration (Southwestern), and Western Area Power Administrations (Western).

⁶Nonfederal plants would include those owned by commercial utilities, municipal utilities, electric cooperatives, public utility districts, or other nonfederal entities.

obtain funding to better maintain and repair the Bureau's and the Corps' plants.

Background

Since about the 1930s, the Bureau and the Corps have operated about 130 hydropower plants that supply about 5 percent of the nation's total electricity supply. These agencies generate electricity in conjunction with other uses of water, such as fish and wildlife enhancements, flood control, irrigation, navigation, recreation, and water supply. The PMAs sell this electricity primarily to wholesale customers (the "power customers"), such as rural electric cooperatives and municipal utilities. The power customers, in turn, sell this electricity to customers at the retail level. In fiscal year 1997, the PMAs had revenues of over \$3 billion from the sale of electricity. A portion of these revenues is used to repay the outstanding appropriated and other debt of about \$22 billion.⁷

The Energy Policy Act of 1992 significantly increased competition in wholesale electricity markets, and 18 states have acted to introduce competition at the retail level. As a result of this competition and new, more efficient generating technologies, prices are expected to continue to decrease by 6 to 19 percent by 2015. In more competitive markets, utility management measures the "reliability" of power plants to decide where to cut costs or how to allocate scarce dollars for maintaining plants. Within the electric utility industry, plants are "reliable" if they can function without failure over a specific period of time or amount of usage.

Results in Brief

The Bureau's and the Corps' hydropower plants are generally less reliable in generating electricity than nonfederal hydropower plants. The reliability of the Bureau's hydropower plants has improved recently, while the Corps' has remained relatively unchanged. Specifically, from 1993 through 1997, the Bureau's units were available to generate electricity an average of about 83 percent of the time compared with about 91 percent for nonfederal units.⁸ The availability of the Bureau's units to generate electricity improved from about 81 percent of the time in 1993 to about 87 percent in 1997. The Corps' units were available to generate electricity an average of about 89 percent of the time during the period 1993 through

⁷As of the end of fiscal year 1997—the latest year for which information was available—Bonneville was responsible for repaying about \$14 billion, and the other PMAs were collectively responsible for repaying about \$8 billion dollars. See *Federal Electricity Activities: The Federal Government's Net Cost and Potential for Future Losses* (GAO/AIMD-97-110 and 110A, Sept. 19, 1997).

⁸The availability of power plants actually pertains to the availability of individual generating units. The availability of power plants to generate electricity is a widely accepted measure of their reliability.

1997.⁹ However, the Bureau's and the Corps' units in the Pacific Northwest—which account for over one-half of the agencies' total hydropower capacity and almost all of the electricity that Bonneville markets—were available about 79 percent and 85 percent of the time, respectively.

The Bureau's and the Corps' plants were less reliable because they could not always obtain funding for maintenance and repairs when needed. GAO found that because of uncertain funding, the agencies delay repairs and maintenance until funds become available. GAO also found that these delays caused frequent, extended outages and inconsistent plant performance. The power marketing administrations' electricity is generally priced less than other electricity. However, as markets become more competitive, the power marketing administrations' customers will have more suppliers from whom they can buy electricity. In some power marketing systems—for example, Bonneville's service area—existing competition has lowered nonfederal electricity rates. As a result, during the mid-1990s, some customers left Bonneville or bought some of their electricity from less expensive sources. As nonfederal electricity rates decline in competitive markets, a portion of the federal government's appropriated and other debt of about \$22 billion may be at risk of nonrecovery if the federal electricity does not continue to be marketable. A factor affecting the marketability of this electricity is its reliability. In addition, the Congress, the Office of Management and Budget, and GAO have been working to help ensure that the purchase and maintenance of all assets and infrastructure have the highest and most efficient returns to the taxpayer and the government.

The Bureau, the Corps, and the power marketing administrations have taken actions to obtain funding to maintain and repair their hydropower plants. In general, these actions involve directly funding maintenance and repairs from the power marketing administrations' electricity revenues or from funds contributed by the power customers. By enabling repairs to be made in a timely manner, these actions have the potential to help to improve the reliability of the power marketing administrations' electricity and to continue their existing rate-competitiveness.

⁹The Bureau's and the Corps units were unable to generate electricity 17 percent and 11 percent of the time, respectively, because of breakdowns, repairs, and maintenance, compared with about 9 percent for nonfederal units.

GAO's Analysis

The Bureau's and the Corps' Hydropower Plants Are Less Reliable Than Nonfederal Plants

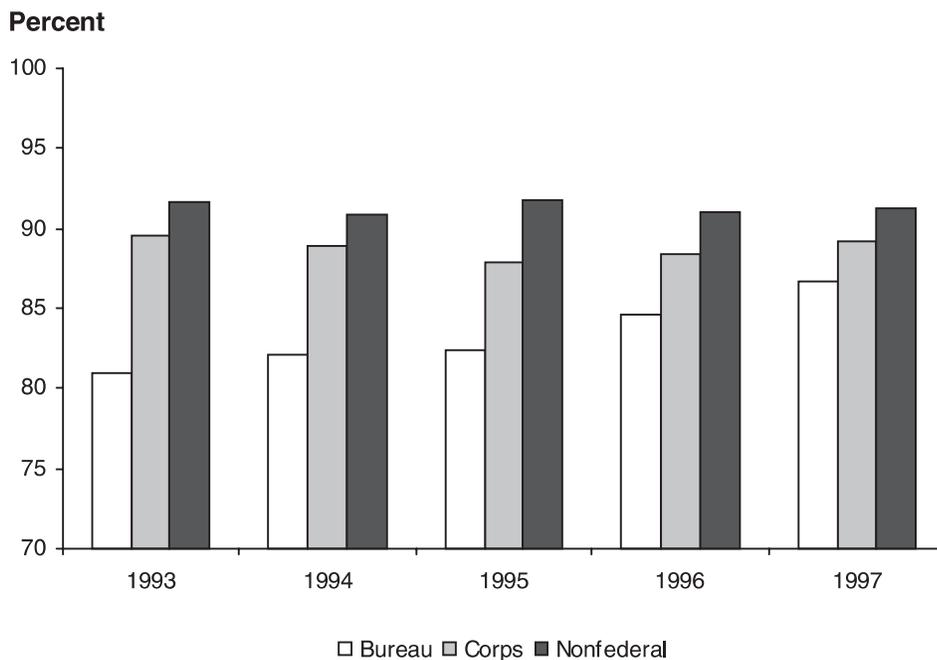
The hydropower plants of the Bureau and the Corps are less reliable in providing electricity than nonfederal hydropower plants. However, the reliability of the Bureau's plants improved while the Corps' has remained relatively unchanged. From 1993 through 1997, the Bureau's and the Corps' hydropower units were available to generate electricity about 83 percent and 89 percent of the time, respectively. Nonfederal hydropower units were available to generate electricity about 91 percent of the time.¹⁰ The availability of the Bureau's units to generate electricity increased from about 81 percent in 1993 to about 87 percent in 1997. (See fig. 1.) At the same time, from 1993 through 1997, the Bureau's units were in outage status¹¹ an average of about 17 percent of the time for breakdowns, repairs, and maintenance, compared with an average of about 9 percent for nonfederal units. The Corps' units were in outage status an average of about 11 percent of the time. In addition, the Corps' units were in forced outage status an average of about 5 percent of the time while nonfederal and the Bureau's units were in forced outage status an average of about 2 percent of the time¹²

¹⁰Availability and outage data were obtained from the North American Electric Reliability Council—an organization formed by the electric utility industry to promote the reliability of the electric supply system of North America.

¹¹“Outage status” means a generating unit was unavailable to generate electricity because of anticipated repairs and maintenance (“scheduled outages”) or unanticipated breakdowns or emergency repairs (“forced outages”). This differs from a utility’s deciding not to operate a unit for reasons unrelated to its operating condition, for example, insufficient or restricted water for operating the plant.

¹²As a result of comments from the Department of Defense (including the Corps), GAO revised the report in chapter 2 to recognize the Corps’ availability factor for 1998 and a decline in the Corps’ forced outage factor for 1998. Defense suggested that GAO include the 1998 data in its figures, but GAO did not do so because comparable data were not available for the nonfederal entities at the time of GAO’s review.

Figure 1: Average Availability Factors of the Bureau's, the Corps', and Nonfederal Hydropower Generating Units, 1993-97



Notes: The percentages are the sum of all units' available hours divided by the sum of all units' period hours. A unit's period hours for a year equal 8,760 hours, or 24 hours multiplied by 365 days.

Sources: The Bureau, the Corps, and the North American Electric Reliability Council.

In addition, forced outages are strong indicators of decreased reliability because they indicate that a utility's units generate electricity inconsistently. According to Corps officials, as a result of major initiatives to rehabilitate its generating units, the agency has reduced its forced outages from almost 6 percent in 1995 to 4.5 percent in 1997.

In the Pacific Northwest, the availability to generate electricity of the Bureau's and the Corps' units was generally lower than it was for the agencies other locations. From 1993 through 1997, the Bureau's units in the Pacific Northwest were only available to generate electricity about 79 percent of the time and were in outage status about 21 percent of the time. The Corps' units in this region were available about 85 percent of the time and were in outage status 15 percent of the time. In contrast,

nonfederal units in the region were available about 90 percent of the time and were in outage status about 10 percent of the time. The reliability of the Bureau's and the Corps' hydropower plants in the Pacific Northwest is important to the overall reliability of the Bureau and the Corps.

Funding Processes' Impacts on the Reliability of the Bureau's and the Corps' Hydropower Plants

The federal planning and budget processes, under which the Bureau and the Corps must operate, do not provide timely and predictable funding needed for the maintenance and repair of hydropower plants. It can take as long as 2 to 3 years before a repair that is identified is funded, if it is funded at all. For example, consistent with the normal budget cycle, in formulating a budget for fiscal year 2000, a regional office of the Bureau began its budget process in August 1997. However, the process will not culminate and the funding level will not be known with certainty until the fiscal year 2000 appropriations act is signed by the President.

Delays in funding federal repairs and the uncertainty about the levels of this funding have caused some maintenance or repairs to be postponed until funds become available. For example, at the Bureau's Shasta plant in California, the need to repair the generating units was identified in 1983. However, funding did not become available until 1995 when the customers provided advance funding. According to a Bureau official, the repairs will not be completed until 2003. Moreover, over time, deterioration at the power plant worsened and, in response, the Bureau reduced the plant's operations.

For the most part, the PMAS' electricity is priced below market, thus helping to ensure that the PMAS' can sell their electricity and helping to secure the repayment of the government's appropriated and other debt. However, in more competitive markets, the PMAS' customers will have a choice of suppliers from which to buy electricity. In such markets, if the reliability of federal electricity continues to be below that of other producers, some of the competitive advantages of the PMAS' electricity would erode, thus decreasing its marketability. This is particularly true in specific PMA systems where the PMAS' electricity is already priced at about the market rate or where competition already exists to the sale of the PMAS' electricity. For example, in Bonneville's service area, competitive challenges exist to the sale of Bonneville's electricity. Bonneville is facing competition from low-cost suppliers of electricity that, during the mid-1990s, caused customers to leave Bonneville and buy electricity at rates below Bonneville's.¹³

¹³See GAO/AIMD-97-110 and 110A.

**Actions Taken to Promote
Faster and More Certain
Funding to Better Maintain
and Repair Federal Plants**

Recognizing the delays and uncertainties that can result from the federal planning and budget processes, the Bureau, the Corps, and the PMAS have acted to secure funding to maintain and repair the federal hydropower plants and related facilities. For example, recognizing the lower reliability of the plants in the Pacific Northwest, from 1993 through 1997, the Bureau, the Corps, and Bonneville concluded four agreements whereby Bonneville's electricity revenues will provide advance funding of over \$1 billion dollars for routine operations and maintenance and capital repairs of the electricity facilities from which it markets electricity.¹⁴ The agencies expect to be able to plan and pay for maintenance and repairs systematically and predictably over several years and to fix unanticipated breakdowns more rapidly. For example, under the Bureau's and Bonneville's December 1996 funding agreement, the Bureau prepares an annual operations and maintenance budget by identifying major line items for each project for funding during the next fiscal year and also for 5 fiscal years. Annual expenditures that are less than the targeted amount are carried over to future years and accounted for in a "savings account," which can be tapped, as provided for in the agreement, to pay for emergency repairs. Annual budgets are proposed and approved less than 1 year in advance, instead of 2 to 3 years, which is the general time frame under the traditional appropriations process. Bonneville believes that the increased demand for its electricity and the increased financial resources provided by the funding agreements would improve its competitive viability and ability to recover the full cost of the electricity system from which it markets power.¹⁵

In addition, at such locations as the Central Valley Project in California and the Pick-Sloan Program in Montana, North Dakota, South Dakota, and nearby states, direct payments from the PMAS' electricity customers have funded the maintenance and repair of the federal power plants and related facilities. As authorized by law, the PMAS' customers can directly pay for the maintenance and repair of the federal power plants and related facilities, but these commitments must be made before the repairs begin. For example, electricity customers have made commitments to pay for future operations and maintenance and some selected repairs of the federal power plants and related facilities in the Central Valley Project.

The direct funding of maintenance and repairs by electricity revenues and customers' financing agreements could diminish opportunities for oversight by the Congress. However, at this time, the Bureau, the Corps,

¹⁴The agreements were concluded pursuant to the Energy Policy Act and other statutes.

¹⁵Bonneville markets electricity from the Federal Columbia River Power System.

and the PMAS provide such information as the history and background of their power plants, the plants' generating capacity and electricity produced, annual electricity revenues and costs, and related environmental and water quality issues to the Congress, other decisionmakers, and the public. The means of communicating this information include the PMAS' annual reports; the PMAS', the Bureau's, and the Corps' Internet Websites; and letters to the appropriate congressional committees.

Recommendations

This report contains no recommendations.

Agency Comments

GAO provided the Department of Energy (which represented the views of Southeastern, Southwestern, and Western), the Department of the Interior (including the Bureau), the Department of Defense (including the Corps), and Bonneville with a draft of this report. The comments of Energy, Interior, Defense, and Bonneville, and GAO's responses to those comments, are included in appendixes II, III, IV, and V, respectively.

The Department of Energy provided technical suggestions for the draft report but deferred to the comments of the Bureau and the Corps on more substantive matters. For example, Energy suggested that GAO clarify the differences between "reliability" and "availability." The report already discusses that plants are viewed as reliable, within the electric utility industry, if they can function without failure over a specific period of time or amount of usage. The report also states that there are several ways of measuring reliability, including the availability factor and outage factors. Accordingly, we made no substantive changes to the report.

The Department of the Interior, including the Bureau, commented that the report did a good job in recognizing the funding needs for operating and maintaining electrical-generating facilities. However, according to Interior, the report should recognize that the Bureau's availability factors are partly the result of the fact that the Bureau's facilities operate to fulfill multiple purposes and that the generation of electricity is secondary to irrigation and other purposes. The report clearly recognizes that water is used for multiple purposes and affects how electricity is generated. For example, the executive summary recognizes that the Bureau and the Corps generate electricity in conjunction with the use of water for flood control, navigation, irrigation, and other purposes. Accordingly, no changes are needed to the report. Also, Interior stated that the reliability of its plants

compares favorably with nonfederal plants, and that the forced outages factor is a better indicator of comparative reliability than the availability factor. GAO does not agree that the Bureau's plants are as reliable as nonfederal plants because, as discussed in this report, the Bureau's plants have lower availability factors and are in outage status more of the time than nonfederal plants. In addition, the report already recognizes that the forced outage factor, along with the availability factor, is viewed as one of the most meaningful ways of measuring reliability. Accordingly, for these points, no changes to the report are needed. Finally, GAO agrees that the availability factor should be interpreted within the context of various factors, some of which the Bureau listed. GAO revised chapter 1 to recognize that assessing the performance of a hydropower plant or unit by examining its availability factor calls for understanding additional variables. GAO added language to reflect that the availability factor needs to be understood in terms of such factors as the role played by the plant in terms of the kind of demand it meets (e.g., whether it meets peak demand), the availability of water throughout the year, and the purposes satisfied by the dam and reservoir.

The Department of Defense, including the Corps, provided verbal comments to clarify its position on GAO's draft report, noting, most significantly, that the report did not reflect changes in the performance of the Corps' hydropower plants that occurred in fiscal year 1998. Defense suggested that GAO include this data in various graphs in its report. GAO revised chapter 2 to recognize the Corps' availability factor for 1998 and a decline in the agency's forced outage factor for 1998. GAO did not include these data in graphs because comparable data were not available for the nonfederal entities at the time of GAO's review.

Bonneville noted that GAO "sought to conduct a fair assessment" of the Corps' and the Bureau's facilities during the time of the study. Bonneville agreed, as stated in the report, that the availability factors of the Bureau's and the Corps' hydropower plants in the Pacific Northwest are lower than in the rest of the nation. However, Bonneville suggested that GAO clarify the report by stating that Bonneville, the Bureau, and the Corps recognized the lower reliability of the plants in the Pacific Northwest and took action through a series of direct-funding agreements to address the problem. Bonneville further suggested a clarification that from 1993 through 1997, the Bureau extensively upgraded and rehabilitated its plants, partly as a result of the increased funding flexibility provided by the direct funding agreements. Chapter 4 already discusses in detail the provisions of the agreements, the \$1 billion of repairs that are being funded as a result of the

agreements, and the expected improvements in the Bureau's planning and budgeting systems that result from them. GAO agrees that the suggested revisions would enhance the reader's understanding of the funding agreements and revised the report to recognize that the increased funding flexibility that resulted from the agreements enabled the Bureau to undertake extensive repairs.

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Abbreviations

GAO	General Accounting Office
MW	megawatt(s)
NERC	North American Electric Reliability Council
OMB	Office of Management and Budget
PMA	power marketing administrations
TVA	Tennessee Valley Authority

Background

The Army Corps of Engineers (the “Corps”) and the Department of the Interior’s Bureau of Reclamation (the “Bureau”) operate about 130 hydropower plants at dams throughout the nation. These plants generate electricity from the flow of water that is also used for other purposes, including fish and wildlife enhancement, flood control, irrigation, navigation, recreation, and water supply. Since about the 1930s, electricity that is generated by these hydropower plants has played an important role in electricity markets. These plants were a key element in electrifying rural and sparsely populated areas of the nation. These plants account for over 35,000 megawatts (MW)¹⁶ of generating capacity (or about 5 percent of the nation’s total electric supply) in 1998. The Department of Energy’s power marketing administrations (PMA)¹⁷ generally market the electricity generated at these plants to wholesale customers (the “power customers”), such as rural electric cooperatives and municipal utilities, that in turn sell the electricity to retail customers. (Fig. 1.1 shows the service areas of the PMAs.) Revenues earned from the sale of this electricity totaled over \$3 billion in fiscal year 1997. These revenues pay for the operation and maintenance of the government’s electricity-related assets and repay a portion of the outstanding federal appropriated and other debt¹⁸ of about \$22 billion for the Bureau’s and the Corps’ power plants, related PMA transmission lines, and well as certain related federal investments for irrigation, water supply, and other facilities that are to be repaid over time from electricity revenues.¹⁹ The revenues also pay interest on the outstanding appropriated debt, where applicable.

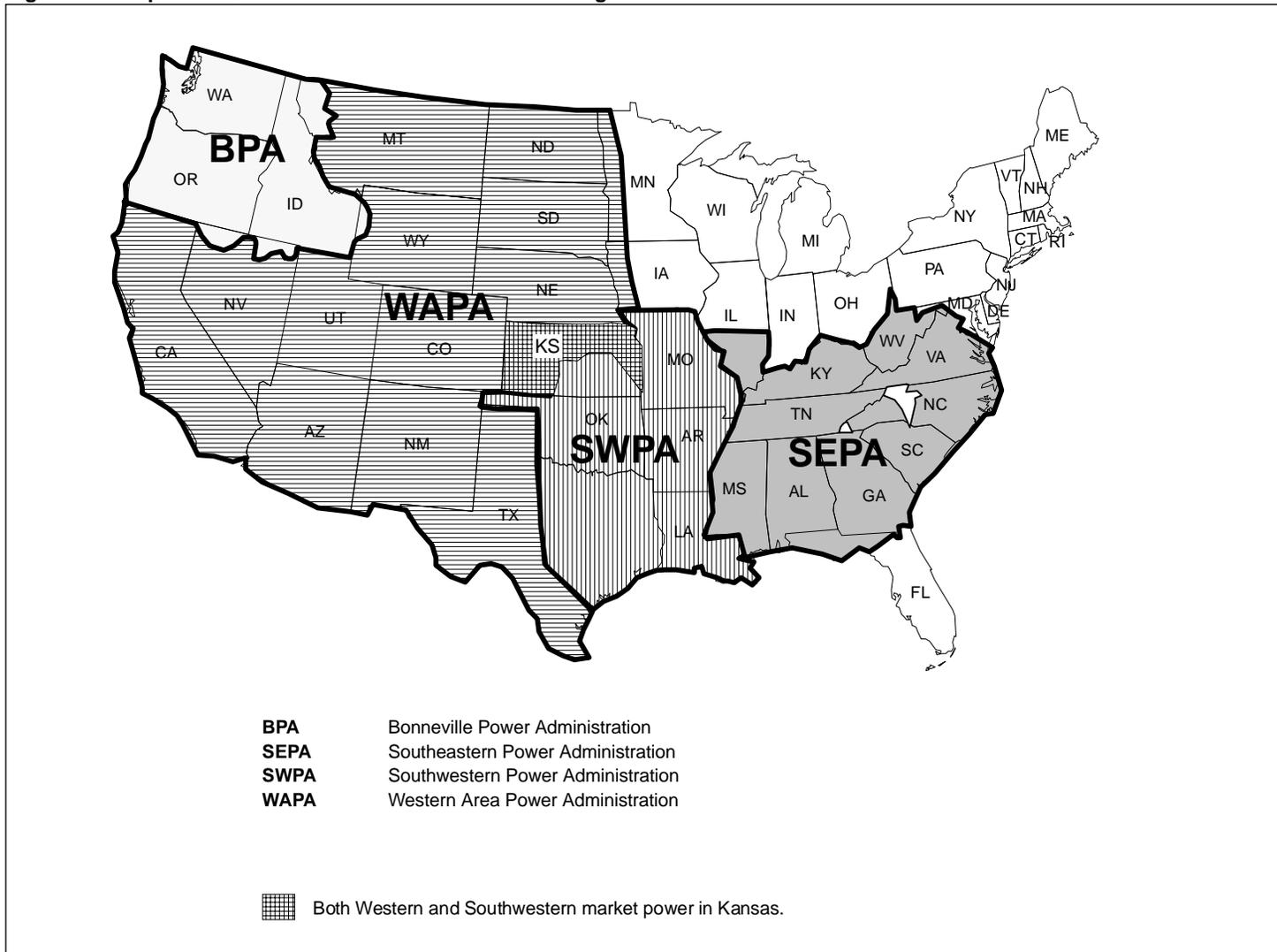
¹⁶A watt is the basic unit used to measure electricity. A megawatt equals 1 million watts. A megawatt-hour is equal to 1 megawatt of electricity applied for 1 hour. A kilowatt-hour equals 1,000 watt-hours.

¹⁷The PMAs are the Bonneville Power Administration (Bonneville), Southeastern Power Administration (Southeastern), Southwestern Power Administration (Southwestern), and Western Area Power Administration (Western).

¹⁸We use the term “appropriated debt” because the PMAs are required to set their electricity rates to generate revenue at levels that will recover appropriations used for capital investments by the Bureau and the Corps. However, these reimbursable appropriations are not considered as lending by the Department of the Treasury. Other debt includes primarily debt for irrigation facilities and debt for certain nonfederal nuclear power plants.

¹⁹As of the end of fiscal year 1997—the latest year for which information was available—the Bonneville Power Administration was responsible for repaying about \$14 billion, and the other PMAs were collectively responsible for repaying about \$8 billion dollars.

Figure 1.1: Map of the Service Areas of the Power Marketing Administrations



Source: Developed by GAO from data provided by the Department of Energy and the PMAs.

Changes in Electricity Markets

In traditional markets, electric utilities enjoyed relative certainty about the amount of demand they would have to satisfy in the future. A compact existed between utilities and state public utility commissions. Utilities were obligated to serve all existing and future customers in their pre-established service areas. In return, utilities were granted monopolies within their service areas and approved rate schedules that guaranteed

stated earnings on their operating costs and investments. They forecasted the load they would serve by using econometric and end-use analyses models over future periods of time that were as long as 20 years. They collected sufficient funds in their electric rates to pay for needed generating capacity and to operate, maintain, and repair existing power plants and other electricity assets. The funds collected through rates also include profits.

However, the nation's electricity markets are undergoing significant changes. The Energy Policy Act of 1992 significantly increased competition in wholesale electricity markets. In addition, competition at the retail level is now arriving. According to the Department of Energy's Energy Information Administration, as of March 1999, 18 states had acted—by legislation that had been enacted (14 states) or by regulatory order (4 states)²⁰—to restructure electricity markets. Regulators in these states expected that industrial, commercial, and, ultimately, residential consumers would be able to choose their electricity supplier from among several competitors, rather than being tied to one utility.

As competition increases, the rates paid by consumers for electricity have dropped and should continue to do so. For example, according to the Energy Information Administration, as a result of such factors as emerging competition and new, more efficient generating technologies, retail electricity rates decreased by about 25 percent from 1982 through 1996, after factoring in the impact of inflation. The administration expects electricity rates to continue to decrease in real terms by 6 percent to 19 percent by 2015.

Utilities Respond to More Competitive Markets

In recent years, uncertainty about the pace and extent of competitiveness in electric markets has caused utilities to be more flexible. Utilities have relied more on purchasing electricity from other sources or acquiring new power plants, such as smaller natural-gas-fired plants, that are less expensive and more flexible for meeting shifting demand. They have also cut costs by reorganizing and reducing staff, and they have consolidated or merged with other utilities where they believed it was appropriate. For example, after years of virtually no mergers, from October 1992 to January 1998, investor-owned utilities had proposed over 40 mergers and completed 17 of them, according to the Edison Electric Institute. In

²⁰The states that enacted legislation were Arizona, California, Connecticut, Illinois, Maine, Massachusetts, Montana, Nevada, New Hampshire, New Jersey, Oklahoma, Pennsylvania, Rhode Island, and Virginia. Other states with regulatory orders were Maryland, Michigan, New York, and Vermont.

addition, according to utility officials, some utilities are retiring or divesting some high-cost power plants, while others are buying those same plants to serve a niche in their resource portfolios.

According to utility officials, in more stable electricity markets, utilities and federal agencies maintained and repaired their hydroelectric and other power plants according to a schedule that was predetermined by the manufacturer's specifications and the operating history of the plant. Maintenance and repairs were frequently made at this predetermined time whether or not they were needed. Because maintenance or repairs could have been performed later or less frequently, perhaps with lower costs, some Bureau and utility officials that we contacted characterized these practices as over-maintenance of the hydropower plants. These practices, according to an industry consultant, were seldom questioned partly because of the low costs and resiliency of hydropower plants—especially of those placed into service during the 1950s.

However, as markets become more competitive, federal agency, utility, and electric industry officials have increasingly viewed hydropower plants as particularly useful to utilities' overall operations. One of hydropower's important traits is its flexibility in meeting different levels of demand. This characteristic, according to utility officials, means that hydropower plants will likely continue to play a significant role in meeting demand during peak periods and providing ancillary services,²¹ without which electricity systems cannot operate. Currently, utilities provide these services routinely. However, according to Bureau, PMA, and utility officials, depending upon actions taken by federal and state regulators in the near future, a separate market may develop for ancillary services. These services may be priced separately and may allow utilities with hydropower to capture a market niche and earn additional revenues.

In response to new markets and perceptions about the role of hydropower in those markets, federal agencies and some utilities have reconsidered how they operate, maintain, and repair their hydropower plants. For example, some utilities have implemented less-expensive, more-flexible maintenance practices, which consider such factors as the generating size of a utility's hydropower plants, those plants' roles in the utility's generation portfolio, and marketing and economic considerations. One such approach, called "Reliability Centered Maintenance," is defined as a maintenance philosophy that attempts to make use of the most logical,

²¹Ancillary services are services or tariff provisions related to the generation and delivery of electricity other than the simple generation, transmission, or distribution of electricity.

cost-effective mix of breakdown maintenance, preventive maintenance, and predictive testing and proactive maintenance to attain the full life of the equipment, reduce maintenance costs, and encourage reliable operations. For example, according to some utilities we contacted, in determining when to maintain or repair equipment, they are relying increasingly on the use of monitoring equipment to detect changes in the operating conditions of the equipment, instead of performing those actions in a prescheduled manner, as in the past. On the basis of these examinations, the utility may decide to repair or replace the component. Alternatively, the utility may decide to stretch out the operation of the component to the point of near-failure. Some components may actually be run until they fail. However, according to Corps and utility officials, in the cases of some smaller hydropower units, installing monitoring equipment at a cost of \$200 to \$500 per unit may not make economic sense. Other measures may also be used to monitor the operating condition of equipment. For example, the Corps tests the lubricating oil to indicate the condition of its generating equipment.

Also, in some cases, when deciding how and when to maintain and repair generating units, management now considers the plant or the unit as an individual cost center that must make a positive contribution to the utility's bottom line. In such an environment, plant managers will become more aware of the production costs and will exert increased pressures to cut costs at the plant and at the corporate levels. Plant managers may become aware that a utility may actually shut down and sell a generating unit if operating or repairing it does not return a required, positive financial return.

Measuring the Reliability of Power Plants

As market competition intensifies, utilities will face increasing pressures to operate as efficiently and cost-effectively as possible. Utilities' management will need to know how well their plants are producing electricity in order to make informed decisions about how to allocate scarce dollars for maintaining and repairing power plants, where to cut costs, or, in more extreme cases, which generating units²² to sell or shut down.²³ An important concept for defining power plants' performance is the "reliability" with which plants generate electricity. Within the electric

²²A power plant is made up of one or more generating units that produce electricity.

²³The Bureau, for example, has "benchmarked" the performance of its hydropower plants against other plants in the industry, using such indicators as the availability, scheduled outage, and forced outages factors. See *Future Generations: A New Era of Power, Performance, and Progress*, Bureau of Reclamation (1996).

utility industry, power plants are viewed as “reliable” if they are capable of functioning without failure over a specific period of time or amount of usage. The availability factor and the related outages factors are widely accepted measures of the reliability of power plants. The time a generating unit is “available” to generate electricity is the time it is mechanically able to generate electricity because it is not malfunctioning unexpectedly or because it is not being maintained or repaired. For instance, if a unit were available to generate electricity 8,000 hours out of the 8,760 hours in a year, then its availability factor would be 8,000 hours divided by 8,760 hours, or about 91.3 percent.

When a unit is unable to generate electricity because it is broken, being repaired, or being maintained, it is in outage status. Outages are further classified as “scheduled” outages if the unit is unable to generate electricity because it is undergoing previously scheduled repairs or maintenance. If a unit is unable to generate electricity because of an unexpected breakdown and/or if unanticipated repairs need to be performed, then it is in “forced outage” status. If a plant were in scheduled outage status for 100 hours over the course of one year, then its scheduled outage factor would be 100 hours divided by the 8,760 hours in a year, or 1.1 percent. If a plant were in a forced outage status for 600 hours, then its forced outage factor would be 600 hours divided by the 8,760 hours in the year, or 6.8 percent of the time. For any generating unit, the availability factor, the scheduled outage factor, and the forced outage factor, added together, should equal 100 percent because, taken together, they account for a plant’s entire operating status over a period of time.

Assessing the performance of a hydropower plant or unit by examining its availability factor calls for understanding additional variables that would affect its performance. Many officials we contacted said that the availability factor needs to be understood in terms of such factors as the role played by the plant in terms of the kind of demand that it meets (for instance, whether it meets peak demand), the availability of water throughout the year, and the purposes satisfied by the dam and reservoir. For example, according to a utility consultant, because water is abundant at the New York Power Authority’s Niagara Power Project, the generating units are used primarily to satisfy nonpeak loads. Therefore, the utility attempts to operate and maintain those units to be on line as much as possible. To do otherwise entails a loss of generating revenues that could be earned almost 24 hours per day. Nevertheless, officials at every utility we contacted said that they achieved an availability of at least 90 percent,

and the Bureau and the Corps have formal goals of attaining that availability level.

Objectives, Scope, and Methodology

As requested by the Chairman, Subcommittee on Water and Power, House Committee on Resources, we examined the (1) reliability of the Bureau's and Corps' hydropower plants in generating electricity compared with the reliability of nonfederal hydropower plants;²⁴ (2) reasons why the Bureau's and the Corps' plants may be less reliable than nonfederal plants and the potential implications of reduced reliability; and (3) actions taken to obtain funding to better maintain and repair the Bureau's and the Corps' plants.

To compare the generating reliability of the Bureau's and the Corps' hydropower plants with nonfederal ones, we obtained, analyzed, and contrasted power plants' performance data, including availability and outages factors, from the Bureau, the Corps, and the North American Electric Reliability Council.²⁵ We discussed the limitations of these performance indicators with officials from the Bureau, the Corps, the PMAS, the Tennessee Valley Authority, investor-owned utilities, publicly owned utilities, and other experts in the electric utility industry.

To explore why federal hydropower plants sometimes performed at lower levels, we obtained and analyzed various reports on the subject and discussed the topic with representatives of the Bureau, the Corps, the PMAS, various PMA electricity customers or their associations, investor-owned utilities, and nonfederal, publicly owned utilities. Moreover, in addressing the implications of any reduced performance by federal plants, we interviewed industry experts, representatives of investor-owned and publicly owned utilities, officials of the PMAS, and the PMAS' electricity customers. We also examined studies about the changes in electricity markets.

In examining steps to secure funding to better maintain and repair the Bureau's and the Corps' plants, we studied the efforts of the Corps, the Bureau, and the PMAS to pay for the maintenance and repair of federal hydropower assets more quickly and with greater certainty. In this regard, we contacted the Bureau, the Corps, the PMAS, and the PMAS' power

²⁴Nonfederal plants would include those owned by commercial utilities, municipal utilities, electric cooperatives, public utility districts, or other nonfederal entities.

²⁵The Council was established by the electric utility industry to promote the reliability of the electricity supply system of North America.

customers at several different locations, including Denver, Colorado; Boise, Idaho; Portland, Oregon; and Sacramento, California. At these locations, we also examined any funding agreements concluded by these parties and asked detailed questions about the benefits and other implications of these agreements. Our analysis was based on the assumption that the Bureau's and the Corps' hydropower plants, the related facilities, and the PMAS would continue to exist under some form of federal ownership. In examining other steps to secure enhanced funding, we relied to the greatest extent possible upon previous work that we had performed on federal electricity, especially work performed during two prior reviews—Federal Power: Options for Selected Power Marketing Administrations: Role in a Changing Electricity Industry (GAO/RCED-98-43, Mar. 6, 1998) and Federal Power: Outages Reduce the Reliability of Hydroelectric Power Plants in the Southeast (GAO/T-RCED-96-180, July 25, 1996).

Our work was performed at many different locations that included various power plants and offices of the Bureau, the Corps, Bonneville, Southeastern, Southwestern, and Western; investor-owned utilities; and publicly owned utilities. We also contacted national and regional industry trade associations.

Our work was performed from July 1998 through February 1999 in accordance with generally accepted government auditing standards. Appendix I contains a more complete description of our objectives, scope, and methodology.

The Bureau's and Corps' Hydropower Plants Are Less Reliable Than Nonfederal Plants

Within the electric utility industry, power plants are viewed as “reliable” if they are capable of functioning without failure during a specific period of time or amount of usage. From 1993 through 1997, the reliability of the Bureau's hydropower plants improved, while the Corps' remained about the same. However, the Bureau's and the Corps' hydropower plants are generally less reliable in generating electricity than nonfederal plants.²⁶ The Bureau's and the Corps' hydropower generating units have been in outage status more of the time for forced and scheduled outages. Importantly, the reliability of the Bureau's and the Corps' plants in the Pacific Northwest is generally below that of Bureau and Corps plants elsewhere and also below that of nonfederal plants in the region and elsewhere. The Bureau's and the Corps' plants in the region account for over half of these agencies' total generating capacity and almost all of the power marketed by the Bonneville Power Administration (Bonneville)—the largest of the PMAs in terms of power sales.

The Bureau's and Corps' Hydropower Generating Units Are Less Available to Generate Power

Nationwide, both the Bureau's and the Corps' generating units are less available to generate electricity than those of nonfederal utilities and providers; however, the Bureau's availability factor has been improving, while the Corps' remained about the same.²⁷ (See fig. 2.1.) Generating units that have malfunctioned unexpectedly or are undergoing maintenance and repairs are not considered to be available. Generating units that are more available to generate electricity are considered to be more reliable. The availability factor is considered to be a key indicator of reliability, according to the Bureau.

From 1993 through 1997, nonfederal hydropower generating units were available to generate electricity an average of 91.3 percent of the time. During that same period, the Bureau's hydropower units were available an average of 83.3 percent of the time (or 8 percent less than the average for nonfederal units) and the Corps' hydropower units were available an average of 88.8 percent of the time (or 2.5 percent less than nonfederal units). The availability factor for nonfederal units from 1993 through 1997 was relatively unchanged. The Bureau's availability factor improved from 80.9 percent of the time in 1993 to 86.6 percent in 1997. The Bureau believes that one reason for its lesser availability factors is that more of its

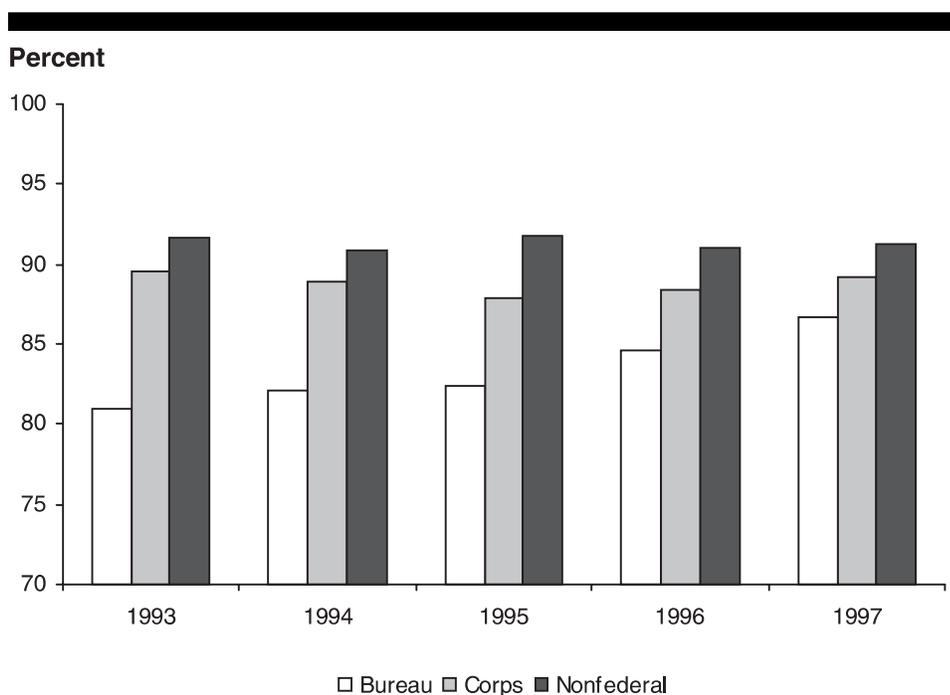
²⁶Nonfederal plants include those of commercial utilities, municipal utilities, electric cooperatives, public utility districts, and other nonfederal entities.

²⁷A generating unit is available to generate power when it is mechanically able to do so. The availability factor is not a measure of whether a plant can or cannot generate power because water cannot be released through the turbines or is otherwise not present for purposes of generating power.

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plants are located on pipelines, canals, and water diversion facilities in comparison with most nonfederal plants. The Corps' availability factor was relatively unchanged—declining slightly from 89.6 percent in 1993 to 89.2 percent in 1997. Corps officials later provided us with data showing an availability factor of 89.5 percent in 1998. Also, the Bureau provided us with data showing an availability factor of 88.5 percent in 1998.

Figure 2.1: Average Availability Factors of the Bureau's, the Corps', and Nonfederal Hydropower Generating Units, 1993-97



Notes: The percentages are the sum of all units' available hours divided by the sum of all units' period hours. A unit's period hours for a year equal 24 hours multiplied by 365 days, or 8,760 hours.

Source: The Bureau, the Corps of Engineers, and the North American Electric Reliability Council.

The Bureau's and Corps' Hydropower Generating Units Are in Outage Status More of the Time Than Nonfederal Units

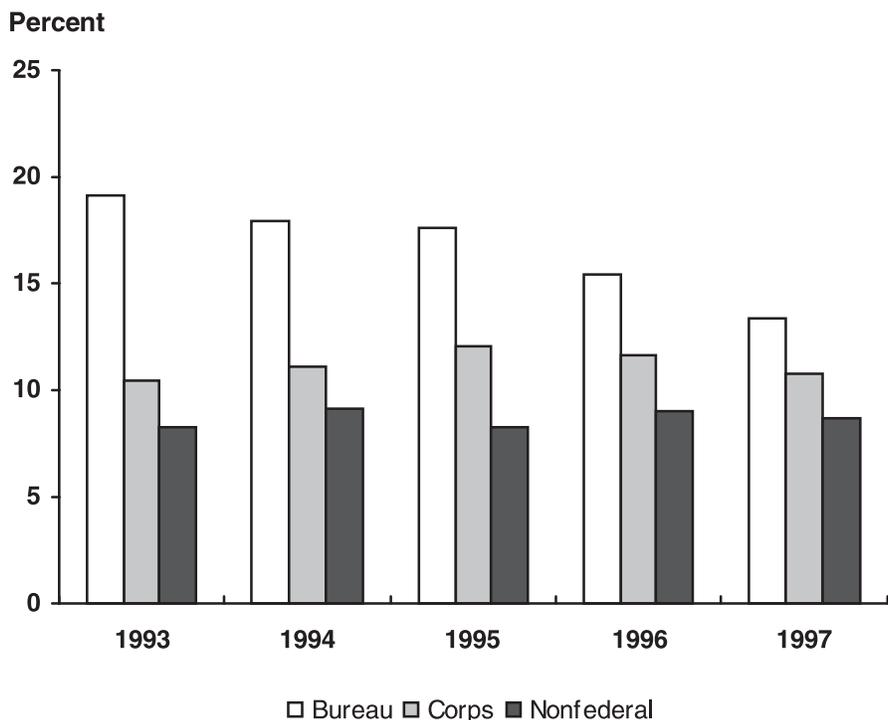
If generating units are not available to generate electricity, they are said to be in “outage” status.²⁸ Because the Bureau's and the Corps' generating units were less available to generate electricity than the rest of the industry, they also had higher outages factors. The longer or more frequent its outages, the less available a unit is to generate electricity. (See fig. 2.2.) From 1993 through 1997, the hydropower units of the Bureau were in outage status an average of 16.7 percent of the time, and the Corps' units were in outage status an average of 11.2 percent of the time. In contrast, nonfederal units were in outage status an average of 8.7 percent of the time.²⁹

From 1993 through 1997, the Corps' total outage factor was relatively unchanged, whereas the Bureau's decreased from 19.1 percent in 1993 to 13.4 percent in 1997. Nonfederal units' total outages factors were relatively unchanged.

²⁸“Outage status” means that a generating unit was unavailable to generate electricity because of anticipated repairs and maintenance (“scheduled outages”) or unanticipated breakdowns or emergency repairs (“forced outages”). Outage status means a unit cannot operate because it is broken, is being maintained, or is being repaired. This differs from a utility's deciding not to operate a unit for reasons unrelated to its operating condition—for example, insufficient or restricted water for operating the plant.

²⁹Except for the Corps in 1993, the total outage factor is the sum of scheduled and forced outages. To compute a total outage factor for the Corps in 1993, we subtracted the Corps' availability factor of 89.6 percent from 100 percent.

Figure 2.2: Total Outages Factors of the Bureau's, the Corps', and Nonfederal Hydropower Generating Units, 1993-97



Note: The percentages are the sum of scheduled and forced outages factors in figures 5 and 6.

Source: The Bureau, the Corps of Engineers, and the North American Electric Reliability Council.

The Corps' Hydropower Generating Units Have Higher Forced Outages, and the Bureau's Have Higher Scheduled Outages

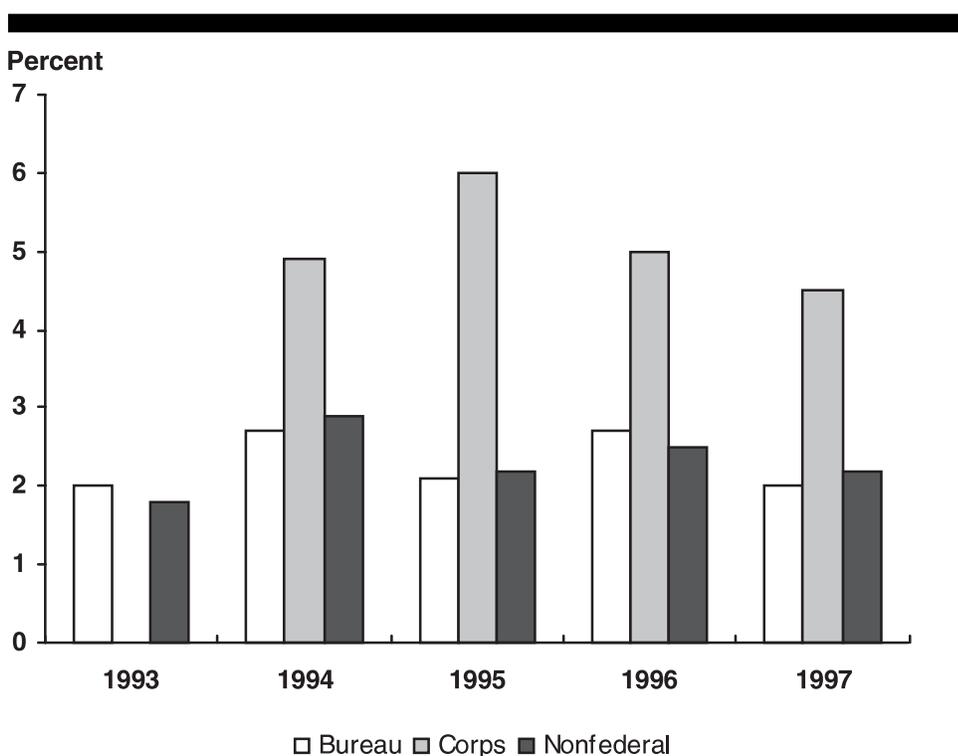
Examining the types of outages that occur indicates why generating units were not in service. Along with the availability factor, the forced outage factor is a key indicator of decreasing reliability because it depicts that unexpected outages occurred, thus indicating inconsistent operations. According to the Bureau's 1996 benchmarking study,³⁰ the lower the forced outage factor, the more reliable the electricity is considered. From 1993 through 1997, the average forced outage factor for the Bureau was 2.3 percent and the Corps' was 5.1 percent. The average forced outage factor for nonfederal hydropower units was 2.3 percent—the same as the Bureau's but less than the Corps'. (See fig. 2.3.) However, it should be noted that the Corps' forced outage factor declined—from almost 6 percent in 1995 to 4.5 percent in 1997. According to the latest data

³⁰A New Era of Power, Performance, and Progress: Future Generations U.S. Bureau of Reclamation (1996).

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provided by the Corps, the agency's forced outage factor declined even further to under 3.2 percent in 1998. According to a Corps official, this improvement is the result of the agency's \$500 million effort, implemented or identified for implementation from fiscal year 1993 through 2009, to rehabilitate its hydropower plants.

Figure 2.3: Forced Outages Factors of the Bureau's, the Corps', and Nonfederal Hydropower Generating Units, 1993-97



Note: The percentages are the sum of all units' forced outage hours divided by the sum of all units' period hours. A unit's period hours for a year, 8,760 hours, equals 24 hours multiplied by 365 days. The Corps did not have 1993 forced outage data.

Source: The Bureau, the Corps of Engineers, and the North American Electric Reliability Council.

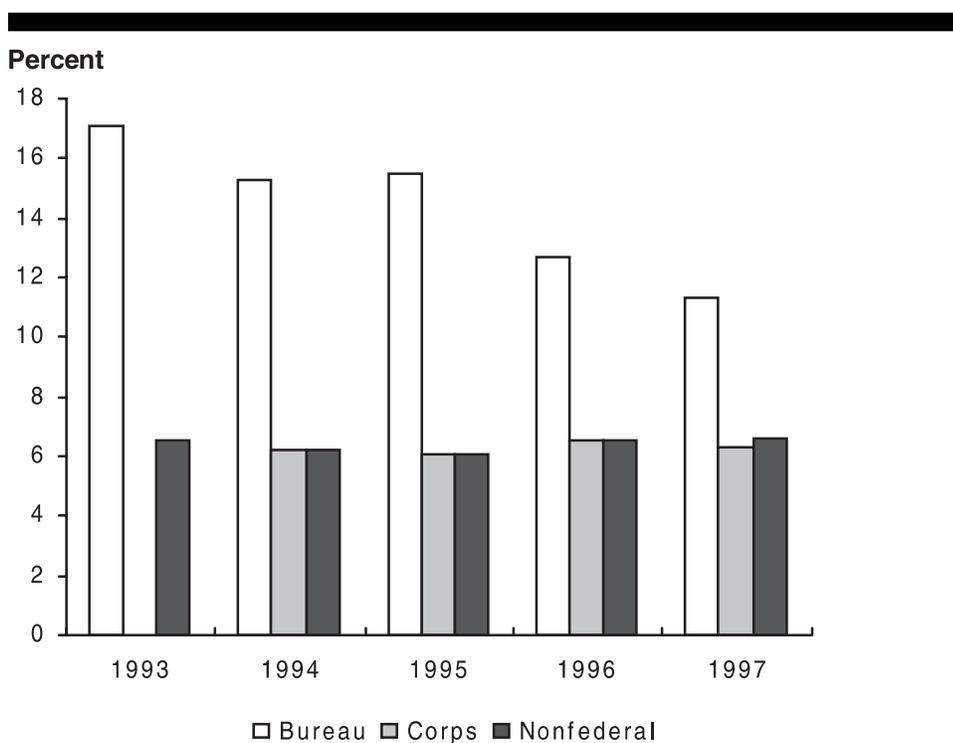
Scheduled outages are, by definition, anticipated. Nevertheless, scheduled outages factors also reflect the amount of time that a generating unit was off-line and unable to provide a utility's customers with electricity. According to the Bureau's 1996 benchmarking study, the longer a scheduled outage, the less efficient the maintenance program. In our view,

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a more efficient maintenance program would have placed the generating unit into service faster, thereby enabling the utility to provide its customers with more service and hence possibly earn more revenues.

In the case of scheduled outages, from 1993 through 1997, the Corps' average scheduled outage factor was 6.3 percent and the Bureau's was 14.4 percent. The average scheduled outage factor for nonfederal utilities was 6.4 percent. However, from 1993 through 1997 the Bureau's scheduled outage rate showed an improvement—decreasing from 17.1 percent in 1993 to 11.3 percent in 1997—while the Corps' and the industry's trends in scheduled outages factors were relatively unchanged. (See fig. 2.4.)

Figure 2.4: Scheduled Outages Factors of the Bureau's, the Corps', and Nonfederal Hydropower Generating Units, 1993-97



Notes: The percentages are the sum of all units' scheduled outage hours divided by the sum of all units' period hours. A unit's period hours for a year, 8,760 hours, equals 24 hours multiplied by 365 days. The Corps did not have 1993 scheduled outage data.

Source: The Bureau, the Corps of Engineers, and the North American Electric Reliability Council.

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Taking longer scheduled outages at opportune times is a management decision that may be considered good business practice, even though such decisions decrease a generating unit's availability to generate electricity. For example, the Bureau and some electric utilities extend scheduled outages to perform additional repairs during periods when the water is not available for generating electricity or the unit is not needed to meet demand. Also, labor costs are minimized by avoiding the payment of overtime wages.

However, according to some Bureau, PMA, and utility officials, these practices may change as markets evolve. Hydropower units may need to be available to generate electricity more of the time in order for the utility to take advantage of new market opportunities. For example, supplying an ancillary service, such as providing reserve capacity, may allow a utility to earn added revenues while not actually generating electricity; however, the unit must be in operating condition ("available") to generate electricity.

Reliability of the Bureau's
and the Corps'
Hydropower Plants in the
Pacific Northwest

The reliability of the Bureau's and the Corps' hydropower plants in Pacific Northwest is important to the overall reliability of the Bureau and the Corps. The generating units of those plants account for over half of the Bureau's and the Corps' total hydropower capacity. In addition, those plants provide almost all of the generating capacity from which Bonneville, the largest PMA, markets electricity. However, the reliability of the Bureau's and the Corps' plants in the Pacific Northwest was below that of nonfederal plants in the region.³¹ In addition, the reliability of the Bureau's and Corps' plants in the region was also generally below that of the Bureau's and Corps' plants elsewhere and below that of nonfederal plants in other regions.³² As shown in chapter 4, Bonneville, the Bureau, and the Corps are undertaking extensive upgrades and rehabilitations of the federal plants. These actions occurred, in part, as a result of the increased funding flexibility provided by the agreements under which Bonneville would directly pay for the operation, maintenance, and repair of these assets.

³¹The region includes the hydropower generating units of the regional reliability council, called the Western Systems Coordinating Council.

³²As shown in this chapter, from 1993 through 1997, nationwide, the average availability of the Bureau's generating units was 83.3 percent of the time, and the Corps' was about 88.8 percent, whereas the nonfederal units' was 91.3 percent.

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The availability factor of the Bureau's units improved over time. The availability of the Corps' units was slightly below that of nonfederal plants, but it declined slightly from 1993 to 1997. However, the Corps' units had a forced outage status over twice as high as that of nonfederal units in the region, indicating inconsistent plant performance, while the Bureau's units had a scheduled outage factor that was almost three times that of nonfederal units.

From 1993 through 1997, the Bureau's units in the Pacific Northwest were available to generate power an average of about 78.7 percent of the time, and the Corps' units were available an average of 85.4 percent of the time. In contrast, nonfederal hydropower units in the region were available an average of 89.7 percent of the time. The Bureau's availability factor improved from a level of 74 percent in 1993 to 85 percent in 1997, and the Corps' availability factor decreased from 87.9 percent in 1993 to 85.7 percent in 1997. In contrast, the availability factors of nonfederal units decreased slightly from 91.8 percent in 1993 to 90.3 percent in 1997.

In the Pacific Northwest, from 1993 through 1997, the Bureau's units were in outage status an average of 21.3 percent of the time, and the Corps' units were in outage status an average of 15.3 percent of the time, compared with an average of 10.3 percent of the time for nonfederal units in the region. The Bureau's outage factor decreased from about 26 percent in 1993 to 15 percent in 1997, while the Corps' increased slightly from 12.1 percent in 1993 to 14.3 percent in 1997. The outage factor for regional nonfederal units increased from 8.2 percent in 1993 to 9.7 percent in 1997.

The Corps' units performed more inconsistently than nonfederal units because from 1993 through 1997, the Corps' units had higher forced outages factors (an average of 6.4 percent) than the Bureau's units (an average of 1.9 percent) and nonfederal units (an average of 3.1 percent). The Corps' forced outage factor in 1994³³ was about 5 percent and increased to over 7 percent in 1995 and 1996, before declining to about 5.6 in 1997. In contrast, the Bureau's forced outage factor was lower than the nonfederal producers' but increased from 1.3 percent in 1993 to 1.9 percent in 1997. Nonfederal producers had a forced outage that increased from 1.5 percent in 1993 to 3.2 percent in 1997. According to the Corps' Hydropower Coordinator, the higher forced outage factor for the Corps' units in the region pertained to the operation of fish screens and other equipment designed to facilitate salmon migrations around the Corps' units. This equipment breaks or needs to be maintained, causing

³³The Corps did not report a forced outage factor in 1993.

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decreases in availability. During fiscal year 1998, at the Corps' McNary and Ice Harbor plants, forced outages related to fish passage equipment were 30 and 15 percent, respectively, of the total hours in which the plants experienced forced outages.

However, from 1993 through 1997, the Bureau's units had higher scheduled outages factors (an average of 19.4 percent) than both the Corps' units (an average of 8.9 percent) and nonfederal units (an average of 7.2 percent). The Bureau's scheduled outages factors were far higher than those of nonfederal parties but decreased from 24.7 percent in 1993 to 13.2 percent in 1997. The Corps' scheduled outage factor decreased from 9.6 percent in 1994 to 8.8 percent in 1997.³⁴ Nonfederal parties had a scheduled outage factor that increased from 6.7 percent in 1993 to 8.4 percent in 1994 before falling to 6.5 percent in 1997.

³⁴The Corps did not report a scheduled outage factor in 1993.

Funding Processes' Impacts on the Reliability of Hydropower Plants

The Bureau's and the Corps' plants were less reliable than nonfederal plants partly because, under the federal planning and budget cycle, they could not always obtain funding for maintenance and repairs when needed. We found that funding for repairs can take years to obtain and is uncertain. As a result, the agencies delay repairs and maintenance until funds become available. In addition, the Anti-Deficiency Act and other statutes require that federal agencies not enter into any contracts before appropriations become available, unless authorized by law. Such delays can lead to maintenance backlogs and to inconsistent, unreliable performance. The PMAS' electricity generally is priced less than other electricity. However, because markets are becoming more competitive, the PMAS' customers will have more suppliers from which they can buy electricity. In some power marketing systems—for example, Bonneville's service area—competition during the mid-1990s allowed some customers to leave or buy some of their electricity from other sources, rather than continuing to buy from Bonneville. Reliability is a key aspect of providing marketable power. For example, according to Bonneville, in large hydropower systems, the PMAS' ability to earn electricity revenues depends, in part, on the availability of hydropower generating units to generate power. In more competitive markets, the reliability of the federal electricity will have to be maintained or improved to maintain the competitiveness of federal electricity and thus help ensure that the federal government's \$22 billion appropriated and other debt will be repaid. In addition, the Congress, the Office of Management and Budget (OMB), and we have been working to help ensure that the purchase and maintenance of all assets and infrastructure have the highest and most efficient returns to the taxpayer and the government.

Funding for Repairs Can Take Years to Obtain and Is Uncertain

The federal planning and budgeting process takes at least 2 full years and does not guarantee that funds will be available for a specific project. This affects the ways in which the Bureau and the Corps plan and pay for the maintenance and repair of their hydropower plants. The federal budgeting process is not very responsive in accommodating the maintenance and repair of those facilities—it can take as long as 2 to 3 years before a repair is funded, if it is funded at all. Specifically, the project and field locations of the Bureau and the Corps identify, estimate the costs of, and develop their budget requests, not only for hydropower, but also for their other facilities, including dams, navigation systems, irrigation systems, and recreational facilities. The funding needs of these various assets compete for the funding and repair of hydropower plants may be assigned lower priorities than other items.

For example, officials of the Bureau's office in Billings, Montana, described the budget process they expected to undergo to develop a budget for fiscal year 2000. The process began in August 1997, when the regional office received initial budget proposals from its area offices. During the ensuing months, the area offices; the region; the Bureau's Denver office; the Bureau's Washington State office; the Office of the Secretary of the Interior; and OMB reviewed, discussed, and revised the proposed area offices' and regional office's budgets, resulting in a consolidated budget for the Bureau and the Department of the Interior. Certainty about expected funding levels will not be obtained until sometime between February 1999, when OMB conveys the President's budget to the Congress, and the enactment and approval of the Energy and Water Appropriations Act. The time that will elapse from August 1997, when the area offices began their budget processes, and October 1999 (the start of fiscal year 2000) totals 26 months.

In addition, funding for the maintenance and repair of the Bureau's and the Corps' hydropower plants is uncertain. Agency officials and other policy makers, faced with limited and scarce resources, especially in times of limited budgets, make decisions about where and where not to spend funds. As shown in examples below, funding is not always delivered to maintain and repair hydropower plants, even if the need is demonstrated.

According to documentation that the Bureau provided us with, in 1983, detailed inspections of the generating units at the Shasta, California, hydropower plant found that generating components were deteriorating. The Bureau advised one of its federal power customers that it would seek funds in fiscal year 1984 for the repairs. However, OMB did not approve the requests because the units were not "approaching a failure mode." Later, in 1990, the Bureau issued invitations to bid for the repairs, which, upon receipt ranged from \$9 million to \$12 million. However, the project was dropped because the Bureau had budgeted only \$6 million. In 1992, after an inspection to determine how far the deterioration had advanced, one generating unit's operations were reduced. The inspectors also recommended repairing the other two units because the gains in generating capacity that would be achieved as a result of the repairs would enable Western to sell more electricity. To fund the repairs, the Bureau requested funds in its fiscal year 1993 budget request; however, according to the Bureau's records, OMB eliminated the request. The Bureau's Budget Review Committee recommended that the project not be included in the

agency's fiscal year 1994 budget request and that the Bureau's regional office "make a concerted effort to find non-federal financing."³⁵

The Corps' Northwestern Division in Portland, Oregon, has also experienced difficulties in funding needed repairs. For example, at the Corps' hydropower plant at The Dalles, Oregon, direct funding by Bonneville allowed the Corps to accomplish maintenance that, according to Corps officials, in all likelihood would not have been funded because of the funding constraints in the federal budget process. Beginning in late 1993, the Corps began preparing an evaluation report that was submitted to headquarters to replace major plant components on 14 units³⁶ that had exhibited many problems over the years but were kept in service through intensive maintenance. The Congress approved funding for the major rehabilitation as part of the Corps' fiscal year 1997 appropriations. However, after 2 of the units were out of service for an extended time, Bonneville and the Corps entered into an agreement in January 1995 for Bonneville to pay for the rewinding of the generator at unit 9. In February 1996, the rewinding of unit 7 was added to the agreement. In addition, Bonneville, in March 1996, agreed to fund the replacement of the excitation systems for The Dalles' units 15 through 22, which were not included in the major rehabilitation funded by appropriations.

Funding Difficulties Lead to Delays of Maintenance That Result in Maintenance Backlogs

Delayed or uncertain funding leads to delays or postponements of needed maintenance and repairs. These delays or postponements can result in maintenance backlogs that can worsen over time. After funding requests are identified and screened, funding may not be made available until up to 3 years in the future. The Corps has estimated a total maintenance backlog of about \$190 million for its power plants in Bonneville's service territory. However, according to Bonneville and Corps officials, the extent to which critical repair items are part of the backlog is a matter yet to be determined. In addition, according to Bonneville and Corps officials, the role of the approximately \$190 million estimate for purposes of planning and budgeting under Bonneville's and the Corps' funding agreements is subject to debate. The Corps' Hydropower Coordinator noted that carrying

³⁵On August 10, 1995, Western's power customers agreed to pay about \$21.5 million to repair the units. According to a Bureau official, this cost included not only rewinding the generators but replacing the turbine runners. Replacing the turbine runners was not previously planned. Officials of the Sacramento Municipal Utility District (a funding contributor) and the Bureau noted that replacing the turbine runners allows the government to better realize the gains in capacity that result from rewinding the generators.

³⁶The Dalles was originally constructed with 14 units. Units 15 through 22 were added later.

a maintenance backlog is not a bad management practice in and of itself, as long as it can be managed through planning and budgeting techniques.

In contrast with the Corps, Bureau officials maintain that they have a policy of not deferring maintenance and repairs they consider to be critical, although noncritical items may be deferred. They added that the Bureau is free to reprogram funds when needed to fund repairs and maintenance. However, we noted that unfunded maintenance requirements for the Bureau exist. In the Pacific Northwest, the Bureau has been able to address these needs by securing new funding sources. Specifically, Bonneville and the Bureau in the Pacific Northwest have signed an agreement under which Bonneville's power revenues will directly pay for about \$200 million of capital repairs at the Bureau's power plants. According to Bureau officials, some of these repairs would likely not have been made under the existing federal planning and budgeting processes because of limited and declining federal budgetary resources. Therefore, it is doubtful that these maintenance needs could have been addressed in a timely manner without a new funding mechanism.

Delayed Repairs Lead to Inconsistent Plant Performance

Failure to fund and perform maintenance and repairs in a timely fashion can lead to frequent and/or extended outages. These outages force the PMAs or their customers to purchase more expensive power than the federal agencies provided in order to satisfy their contractual requirements. For example, from 1990 through 1992, two or more units of the Corps' Carters hydropower plant, in Georgia, were out of service at the same time for periods ranging from about 3 months to almost 1 year. A Southeastern official estimated that its wholesale customers had purchased replacement electricity for about \$15 million more than they would have paid for power marketed by Southeastern. In another example, Southeastern officials estimated that customers of its Georgia-Alabama-South Carolina system had paid 22 percent more in 1990 than in the previous year partly as a result of extended, unplanned outages. Other factors that led to the rate increase included a drought and increases in operation and maintenance costs at the Corps' plants. In addition, as previously noted in our Shasta example, the Bureau restricted the operation of one of the plant's generators in response to deteriorating operating conditions.

**Utilities Attempt to Avoid
Extended Outages by
Ensuring Sufficient
Funding to Maintain and
Repair Their Power Plants**

Although the average nonfederal hydropower generating unit is older (48 years) than the Bureau's (41 years) and the Corps' (33 years), the nonfederal units' availability to generate power is greater than the Bureau's and the Corps'. This is true because, according to utility officials, utilities ensure that sufficient funds exist to repair and maintain their generating units and thus promote a high level of generating availability. According to officials from three investor-owned utilities or holding companies³⁷ and four publicly owned utilities with an average of about 2,458 MW of hydropower generating capacity,³⁸ their hydropower units were available at least 90 percent of the time—sometimes in ranges approximating or exceeding 95 percent. Some officials said they would not tolerate significant reductions in their generating availability because their hydropower units play key roles in meeting demand during peak times.

Under the traditional regulatory compact between states' public utility commissions and utilities, the utilities have an obligation to provide all existing and future loads in their service territories with power. According to utility officials, to comply with these obligations, utilities implement planning and budgeting systems that ensure that they can pay for all necessary maintenance costs as well as critical repairs and replacements in a timely fashion.

According to some utility officials, unlike under the federal budgeting system, utilities typically have the financial capability to quickly obtain funding to pay for unexpected repairs to their power plants. According to these officials, utilities are also able to accumulate funds in reserves to meet future contingencies, such as unexpected breakdowns and repairs of generating units. In addition, issuing bonds but allowing work to begin prior to the bond's issuance is another tool that utilities use to pay for and make repairs very quickly. For example, according to officials of the Douglas County Public Utility District, the utility district can respond quickly to an unexpected breakdown because (1) it has access to some reserve funds, (2) its commissioners can approve funding via the issuance of bonds up to 18 months after work was begun on a repair, and (3) its budgeting process is fast and accurate. For example, the utility district in January 1999 was completing work on the budget for the next fiscal year that would begin in only 8 months—namely, August 1999. The budget for the utility district's hydropower project reflects funding requirements for

³⁷Idaho Power, Pacific Gas and Electric, and the Southern Company.

³⁸Chelan County Public Utility District, Washington State; Douglas County Public Utility District, Washington State; Grant County Public Utility District, Washington State; and the New York Power Authority.

operations, maintenance, anticipated repairs, and debt service, on the basis of the long-term operational and financial history for the project. According to Bonneville, the agency is achieving a similar effect by being able to quickly provide access to funds and establish reserve funds through agreements whereby its funds directly pay for the operation, maintenance, and repair of the Bureau's and the Corps' hydropower plants.

Inadequate Funding for the Maintenance and Repair of Federal Hydropower Plants May Impact Marketability of Federal Electricity

In competitive markets, the price being charged for the electricity and the reliability of that electricity will continue to be important factors that consumers will consider when making purchasing decisions. On average, the electricity sold by the PMAS has been priced less than electricity from other sources. However, failing to adequately maintain and repair the federal hydropower plants causes costs to increase and decreases the reliability of the electricity. The PMAS' rates will have to be maintained at competitive levels, and the reliability of this power will have to be maintained or enhanced to ensure that federal electricity remains marketable. In addition, the Congress, OMB, and we have been working to help ensure that the purchase and maintenance of all assets and infrastructure have the highest and most efficient returns to the taxpayer and the government.

Delayed and unpredictable federal funding for maintenance and repairs have contributed to the decreased availability (and reliability) of the federal hydropower generating units as well as to higher costs that can cause rates to increase if those costs are included in the rates. However, in competitive markets, increased rates decrease the marketability of federal electricity, as nonfederal electricity rates are expected to decline. Customers are expected to have opportunities to buy electricity from any number of reasonably priced sources. If the PMAS' rates are higher than prevailing market rates, customers will be less inclined to buy power from the PMAS. According to the Department of Energy's Energy Information Administration, retail rates nationwide by 2015 may be about 6 to 19 percent (after inflation) below the levels that they would have been if competition had not begun. In certain PMA systems—for example, the Central Valley Project, which, as of fiscal year 1997, had an appropriated and other debt of about \$267 million—the PMAS' electricity (in this case, supplied by Western) is already facing competition from nonfederal generation. If the price of the PMAS' electricity exceeds the market price, then its marketability would be hampered.

Any factors that can cause the PMAS' electricity rates to increase or that decrease reliability decrease the marketability of federal electricity. The marketability of the federal electricity will need to be maintained, as markets become more competitive, in order to ensure the repayment of the federal appropriated and other debt. For example, in 1994, in evaluating the financial status of Bonneville, we noted that:

“. . . [Bonneville's] financial viability would also be jeopardized if the gap between [Bonneville's] rates and the cost of alternative energy sources continues to narrow. Such a scenario could cause some [Bonneville] customers to meet their energy needs elsewhere, leaving a dwindling pool of ratepayers to pay off the substantial debt accumulated from previous years.”³⁹

In Bonneville's service area, during the mid-1990s, competition decreased nonfederal electric rates, resulting in some customers leaving or buying power from less expensive sources, rather than continuing to buy from Bonneville.

Similarly, in the case of the Tennessee Valley Authority (TVA)—a federally owned corporation that supplies electricity in Tennessee and six other Southeastern states), TVA's sales to industrial customers declined from about 25 billion kWh in 1979 to 16 billion in 1993 after double-digit annual rate increases.⁴⁰

³⁹Bonneville Power Administration: Borrowing Practices and Financial Condition (GAO/AIMD-94-67BR, Apr. 19, 1994).

⁴⁰Tennessee Valley Authority: Financial Problems Raise Questions About Long-term Viability (GAO/AIMD/RCED-95-134, Aug. 17, 1995).

Actions Taken to Promote Faster and More Certain Funding to Better Maintain and Repair the Bureau's and Corps' Plants

Various actions have been used to fund the maintenance and repair of federal hydropower facilities. If these actions work as intended, they have the potential to deliver dollars for maintenance and repairs faster and with more certainty than before these actions were implemented. By enabling repairs to be made on time, they have the potential to help improve the reliability of the PMAS' electricity and to continue its existing rate-competitiveness. Hence, these actions can help to secure the continued marketability of the PMAS' electricity and promote the repayment of the appropriated and other debt. However, these various actions may reduce opportunities for congressional oversight of the operation, maintenance, and repair of federal plants and related facilities and reduce flexibility to make trade-offs among competing and changing needs.

Direct Funding by Electricity Revenues May Pay for Over \$1 Billion for Maintenance and Repairs

Aware of the problems involved in securing funding through federal appropriations, the Bureau, the Corps, the PMAS, and PMA customers have begun to take actions to secure the funding that is required to maintain and repair the federal hydropower plants and related facilities. An example is the Bureau's, the Corps', and Bonneville's agreements in the Pacific Northwest, concluded from 1993 to 1997 and made pursuant to the Energy Policy Act and other statutes. According to Bureau officials, these funding arrangements were caused by budget cuts during the 1980s. They added that the need to perform about \$200 million in electricity-related maintenance in the near future would strain the agency's ability for maintenance and repairs in a steady, predictable fashion. These officials said that, as a result of these funding shortfalls, maintenance backlogs accumulated and the generating availability of the federal power plants in Bonneville's service area declined from 92 to 82 percent. In response, in 1988, the Secretary of the Interior requested that the Congress authorize Bonneville to directly fund certain maintenance costs. Such authority was granted in provisions of the Energy Policy Act, which authorized the funding agreements between Bonneville, the Bureau, and the Corps.

Under these agreements, Bonneville's electricity revenues will directly pay for over \$1 billion of routine operations and maintenance as well as capital repairs of the Bureau's and the Corps' electricity assets in Bonneville's service territory. The agencies expect to be able to plan and pay for maintenance and repairs in a systematic, predictable manner over several years. The agencies expect that the resulting funding will allow them to respond with greater flexibility and speed to the need to repair hydropower plant equipment. According to Bonneville, the funding

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Actions Taken to Promote Faster and More
Certain Funding to Better Maintain and
Repair the Bureau's and Corps' Plants

agreements will create opportunities for the increased availability of hydropower, financial savings, and the increased revenues. In addition, Bonneville believes that increased demand for its electricity and the increased financial resources provided by the funding agreements will improve its competitive viability and ability to recover the full cost of the electricity system from which it markets power.⁴¹

The Bureau and Bonneville signed two agreements for Bonneville's electricity revenues to pay up front for capital repairs and improvements as well as ordinary operations and maintenance of the Bureau's electricity assets in Bonneville's service area. In January 1993, the Bureau and Bonneville executed an agreement that provided for funding by Bonneville of specific capital items, as provided by subsequent "subagreements." To date, several subagreements have been signed under which Bonneville will pay, up front, up to about \$200 million for major repairs of the Bureau's hydropower plants in Bonneville's service territory. For example, Bonneville will spend about \$125 million from 1994 through 2007 for upgrades of the turbines of 18 generating units at the Bureau's Grand Coulee power plant, in Washington State.

In addition, in December 1996, the Bureau and Bonneville executed an agreement whereby Bonneville agreed to directly pay for the Bureau's annual operations and maintenance costs as well as selected "extraordinary maintenance," replacements, and additions. The parties anticipated that funding under terms of the agreement would total about \$243 million—ranging from about \$47 million to about \$50 million per year from fiscal year 1997 to fiscal 2001.

The Corps and Bonneville have also signed two agreements that allow Bonneville's electricity funds to directly pay for the operation, maintenance, and repair of the Corps' electricity assets. The first agreement, signed in 1994, was implemented by a series of subagreements, under which about \$43 million in capital improvements and emergency repairs are being funded by Bonneville's electricity revenues. For example, under one subagreement, about \$29 million will be spent for reliability improvements at 21 of the Corps' power plants throughout Bonneville's service area. Bonneville is also paying for over \$5 million in repairs at The Dalles, Oregon, power plant that were requested but not approved under the appropriations process. Other work at The Dalles is currently funded by appropriations. In December 1997, Bonneville and the Corps signed a second agreement under which Bonneville will directly pay for annual

⁴¹Bonneville markets power from the Federal Columbia Rivers Power System.

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Pacific Northwest's Funding
Initiatives Include Systematic
Planning and Budgeting
Processes

operations and maintenance expenses, for Bonneville's share of joint project costs allocated to electricity revenues for repayment, and for some small replacements at the Corps' projects from which Bonneville markets electricity. The implementation of this agreement will begin in fiscal year 1999 with an established budget of \$553 million from fiscal 1999 through fiscal 2003—about \$110 million per year.

Because the implementation of the Pacific Northwest funding agreements is still relatively new, it is too early to determine if they will result in improvements to the availability factors of the Bureau's and the Corps' hydropower plants. At the same time, these efforts include a comprehensive attempt, that in our view, establishes systematic methods for identifying and budgeting for routine operations and maintenance, as well as for capital repairs, rehabilitations, and replacements of the federal hydropower plants in the region.⁴² For example, pursuant to the December 1996 funding agreement, the Bureau prepares an annual operations and maintenance budget by identifying major line items for each project during the next fiscal year. The Bureau also prepares 5-year budgets, on the basis of estimated budgets for each of the years that are included. The funding totals for the 5-year period cannot be exceeded, although any expenditures in a year that are less than the targeted amount are carried over to future years as accounted for in a "savings account." The Bureau and Bonneville formed a "Joint Operating Committee" to vote on and approve the annual and 5-year budgets as well as any modifications to the budgets. Similarly, the December 1997 operations and maintenance funding agreement between the Corps and Bonneville features annual and 5-year budgets that are voted upon and approved by the Joint Operating Committee. Five-year budget totals cannot be exceeded without the Committee's approval, but the reallocation of funds is possible. In addition, if "savings" occur in any year, they are shared between Bonneville and the Corps and/or carried over to future years.

In addition, annual budgets are proposed and approved less than 1 year in advance instead of 2 to 3 years in advance—as under the traditional federal appropriations process. These budget practices reflect more immediate considerations and, in the views of agency officials, are more realistic than budgets that have to be compiled 2 to 3 years ahead of time.

⁴²See Executive Guide: Leading Practices in Capital Decision-Making (GAO/AIMD-99-32, Dec. 1998). That report identifies practices used by leading organizations to make capital investment decisions. These include evaluating and ranking capital assets on the basis of established criteria and balancing control and flexibility when funding capital projects.

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**Enhanced Set-Aside Funds
Made Available**

The potential advantages of the funding agreements in the Pacific Northwest include enhancing the agencies' ability to accumulate funds in the "savings accounts" to pay for emergency repairs, as provided by the agreement. According to Bureau officials, the savings can be reallocated between projects on the basis of a telephone call between the Bureau and Bonneville. The ability of nonfederal utilities to quickly access reserve funds to meet emergency needs was mentioned by some nonfederal utilities when they discussed their planning and budgeting processes with us.

In addition to the funds in savings, a variety of funding sources can be used to pay for maintenance and repairs, including emergency actions. For instance, according to Bureau officials, if unexpected repairs need to be performed, moneys to pay for them may be obtained via a subagreement between the Bureau and Bonneville. Work on the repairs could begin prior to Bonneville's and the Bureau's signing of the subagreement. According to Corps officials, some ongoing rehabilitations of the Corps' Bonneville and The Dalles projects will continue to be funded with appropriations; however, maintenance or repairs to be supported under the funding agreements will no longer be included in the Corps' budget requests for appropriations. To pay for the maintenance and repair of the Bureau's and the Corps' hydropower plants, Bonneville can use its cash reserves or its bonding authority.

**Pacific Northwest's Initiatives
May Allow Agencies to Adapt
New, More Flexible
Maintenance Practices**

Because the agreements provide more secure and predictable funding, the Bureau and the Corps have begun to exercise greater flexibility in how they maintain and repair their hydropower plants. Consistent with evolving market competition and with the actions of nonfederal utilities, Bureau and the Corps officials said their personnel will rely less on traditional, prescheduled maintenance and rely more on newer, more flexible maintenance philosophies, such as reliability-centered maintenance. For example, according to Bureau officials at the agency's Pacific Northwest region, staff at the region's electricity projects schedule maintenance and repairs, in part, by using a database that shows when maintenance and repairs were last performed and when a part may need maintenance or repairs in the future. Repairs or upgrades will be increasingly made "just-in-time" on the basis of test results. Bureau officials characterized their maintenance philosophy as evolving to be more responsive to Bonneville's marketing requirements as well as to reduce costs.

According to these officials, because they now have funds that can be used to pay for emergency repairs, they can take prudent risks in managing their maintenance requirements by deferring some repairs that perhaps can be made just in time or repairing other items that may have higher priority. For example, according to the managers of the Grand Coulee power plant, the new funding flexibility allowed the Bureau to reschedule the spending of up to about \$3 million on repairs at the plant.

Initiatives for Funding by Customers Are Being Implemented

Direct contributions from customers have been suggested and implemented as one way to improve how the Bureau, the Corps, and the PMAS pay for repairs. Although the use of nonfederal funds to finance federal agencies' operations is generally prohibited unless specifically authorized by law, several forms of alternative financing have been statutorily authorized by the Congress. Supporters of alternative financing, among them officials from the Bureau, the Corps, the PMAS, and the PMAS' electricity customers, note that alternative financing allows repairs and improvements to be made more expeditiously and predictably than through the federal appropriations process. They believe that alternative financing could provide more certainty in funding repairs and help address problems such as deferred maintenance at federal plants.

Through one type of authorized arrangement, referred to, among other names, as "advance of funds," nonfederal entities, such as preference customers, pay up front for repairs and upgrades of the federal hydropower facilities.⁴³

Under federal statutes, such funding must be ensured before work on a project can be started. Such funding arrangements have been proposed and/or implemented in a variety of PMA systems, most prominently Western's Pick-Sloan Program in Montana, North Dakota, South Dakota, and several neighboring states; Loveland Area Projects in Colorado and nearby states; Hoover and Parker-Davis projects in Arizona and Nevada; and Central Valley Project in California. For example, under an agreement executed on November 12, 1997, by the Bureau, Western, and Western's power customers within the Central Valley Project, the customers agreed to pay up front for electricity-related operations and maintenance and certain capital improvements. These activities are specified in a funding

⁴³According to a Corps official, the Corps' authority to accept outside funding is much narrower than the Bureau's. The Corps' authority, pursuant to 33 U.S.C. 701h, allows contributions only for flood control work and only from states and political subdivisions. The Corps' authority to upgrade hydropower facilities was further limited by section 216 of the Water Resources Development Act of 1996.

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plan developed by a Governance Board that represents the Bureau, Western, and the electricity customers. In approving spending proposals, the Bureau and Western have veto power and two-thirds of the customers represented on the Board must approve a proposal for it to pass. The customers will be reimbursed for their contributions by credits on their monthly electricity bills.

However, advance of funds agreements generally are limited in their ability to free the funding for the maintenance and repair of federal electricity assets from the uncertainties of the federal budget process. They supplement rather than completely replace federal appropriations and, therefore, may enhance the certainty of funding for repairs and maintenance but not necessarily provide more speed in obtaining that funding. For example, in Bonneville's service territory, Bonneville, the Bureau, and the Corps can budget 1 year in advance; however, under the Central Valley Project agreement, the Governance Board approves electricity-related operations and maintenance budgets 3 years in advance to coincide with the federal budget and appropriation cycles for the Bureau and Western. The dovetailing is necessary because federal appropriations are counted upon to fund the balance of the maintenance and repairs of the federal electricity assets.

Depending on how they are implemented, the direct funding of maintenance and repairs by electricity revenues and agreements for funding by customers pose the risk that opportunities for oversight by external decisionmakers, such as the Congress, will be diminished. Also, the lack of oversight limits Congress's flexibility to make trade-offs among competing needs. As the Congress and other decisionmakers examine the need for new arrangements to fund the maintenance and repair of federal hydropower plants, they may need to consider any reduced opportunities for oversight, along with the potential benefits of these funding arrangements. At this time, the Bureau, the Corps, and the PMAs provide such information as the history and background of their power plants; the power plants' generating capacity and electricity produced; annual electricity revenues, costs, and the repayment status; and related environmental and water quality issues, to the Congress, other decisionmakers, and to the public in general. The means of communicating this information include the PMAs' annual reports; the PMAs'; the Bureau's, and the Corps' Internet Websites; and letters to the appropriate congressional committees.

Objectives, Scope, and Methodology

As requested by the Chairman, Subcommittee on Water and Power, House Committee on Resources, we examined (1) the reliability of the Bureau's and Corps' hydropower plants in generating electricity compared with the reliability of nonfederal hydropower plants;⁴⁴ (2) reasons why the Bureau's and the Corps' plants may be less reliable than nonfederal plants and the potential implications of reduced reliability; and (3) actions taken to obtain funding to better maintain and repair the Bureau's and the Corps' plants.

To compare the generating reliability of the Bureau's and the Corps' hydropower plants with that of nonfederal ones, we obtained, analyzed, and contrasted power plant performance data, including availability and outage factors, from the Bureau, the Corps, and the North American Electric Reliability Council (NERC). NERC is a membership of investor-owned, federal, rural electric cooperatives, state/municipal/provincial utilities, independent power producers, and power marketers, whose mission is to promote the reliability of the electricity supply for North America. NERC compiles statistics on the performance of classes of generating units, such as fossil, nuclear, and hydro. The statistics are calculated from data that electric utilities report voluntarily to NERC's Generating Availability Data System. The data reported to NERC exclude many hydropower units, which, on average, are smaller in generating capacity than those that report to NERC. According to the Department of Energy's Energy Information Administration, as of January 1998, hydropower in the United States was generated by a total of 3,493 generating units with a capacity of 91,871 megawatts (MW). As shown in table I.1, the federal and nonfederal hydropower generating units included in our report totaled 1,107 generating units and had a total generating capacity of 70,005 MW, or an average generating capacity of 63.2 MW per unit. Therefore, the nonreporting units totaled 2,386, and had a total generating capacity of 21,866 MW, or an average generating capacity of 9.2 MW per unit. To compare the performance of federal hydropower generating units with that of nonfederal units, we used data on hydropower generating units from NERC's database that excluded federal hydropower generating units. We did not evaluate NERC's validation of the industry's data, nor the specific input data used to develop the database. We collected 1998 availability and outage data for the Bureau and the Corps, but we did not present it in our graphs because comparative data for the nonfederal units were not available from NERC at the time we completed our study. We also did not evaluate the specific input data used

⁴⁴Nonfederal plants include those owned by commercial utilities, municipal utilities, electric cooperatives, public utility districts, and other entities.

by the Corps and the Bureau to develop their databases on the performance of federal generating units. Table I.1 depicts some of the characteristics of the hydropower generating units included in our analysis of the performance of the Bureau's, the Corps, and industry's generating units. Data for nonfederal units is from 32 nonfederal utilities.

Table I.1: Characteristics of Bureau, Corps, and Nonfederal Hydropower Generating Units as of 1997

Agency	Average age of generating units (years)	Number of generating units	Nameplate capacity of generating units (MW)	Average nameplate capacity of generating units (MW)
Bureau	41	188	14,515	77
Corps	33	349	20,720	59
Nonfederal	48	570	34,770	61

Note: We excluded units at two of the Bureau's power plants from our analysis—The Boise River Diversion because it has not operated in several years, and the Lewiston plant because it is a small (less than 1 MW) station service power plant for the Trinity power plant.

Source: U.S. Bureau of Reclamation, U.S. Army Corps of Engineers, and NERC.

We discussed the limitations of these performance indicators with officials from the Bureau, the Corps, the Tennessee Valley Authority, investor-owned utilities, publicly owned utilities, and other experts in the electric utility industry.

To explore why federal hydropower plants sometimes performed at lower levels, we obtained and analyzed various reports on the subject, and discussed the topic with representatives of Bonneville, the Bureau, the Corps, various power marketing administration (PMA) power customers or their associations, investor-owned utilities, and nonfederal, publicly owned utilities. In our analysis, we included information obtained from the Tennessee Valley Authority, a federally owned utility with high performance indicators and significant hydropower resources.

In addressing the implications of any reduced performance by federal plants, we interviewed industry experts, representatives of investor-owned and publicly owned utilities, and officials of PMA power customers. We also examined studies about the changes in electricity markets and contacted national and regional trade associations. Moreover, we addressed alternative ways of ensuring the enhanced funding of maintenance and repairs of the federal hydropower plants and related facilities. In this regard, to the extent possible, we relied upon previous work that we had

performed on federal power, especially work performed during two prior reviews: *Federal Power: Options for Selected Power Marketing Administrations: Role in a Changing Electricity Industry* (GAO/RCED-98-43, Mar. 6, 1998) and *Federal Power: Outages Reduce the Reliability of Hydroelectric Power Plants in the Southeast* (GAO/T-RCED-96-180, July 25, 1996). Moreover, we examined the Corps', the Bureau's, and the PMAS' efforts to make power revenues directly finance the maintenance and repair of federal hydropower assets. In this regard, we contacted the Bureau, the Corps, Bonneville, Western, and the PMAS' power customers and examined various agreements of arrangements to pay for the maintenance and repair of the federal hydropower plants and related facilities.

Our work was performed at various locations, including the offices of federal and nonfederal parties. Regarding the Corps, these locations include the agency's headquarters, Washington, D.C.; the Northwestern Division, Portland, Oregon; the Portland, Oregon, District; and the Nashville, Tennessee, District. Because the Corps' power operations have been affected by the need to accommodate the migrations of salmon, we also contacted the Walla Walla and Seattle, Washington, Districts, and the Corps' Bonneville (Oregon) power plant. We visited the Bureau's offices at the Department of the Interior in Washington, D.C.; Denver, Colorado; the Central Valley Operations Office, Sacramento, California; the Pacific Northwest Region, Boise, Idaho; and the Grand Coulee, Washington, power plant. To gain a perspective on how another federal electricity-generating entity operated its hydropower program, we interviewed TVA officials in Chattanooga, Tennessee. Moreover, we contacted the PMAS at locations including their Power Marketing Liaison Office, U.S. Department of Energy, Washington, D.C.; Bonneville in Portland, Oregon; Southeastern in Elberton, Georgia; Southwestern in Tulsa, Oklahoma; and Western in Golden and Loveland, Colorado, and Folsom, California.

Our scope included contacting several PMA customers or associations that represent PMA customers, including the City of Roseville, California; Colorado River Energy Distributors Association, Tuscon, Arizona; the Midwest Electric Consumers Association, Denver, Colorado; the Northern California Power Agency, Roseville, California; and the Sacramento (California) Municipal Utility District. In addition, we contacted several investor-owned utilities, utility holding companies, and nonfederal publicly owned utilities (other than those previously listed) that operate significant amounts (collectively, over 17,000 MW) of hydropower-generating

Appendix I
Objectives, Scope, and Methodology

capacity; they included the Chelan County (Washington) Public Utility District; Idaho Power Company; Grant County (Washington) Public Utility District; Douglas County (Washington) Public Utility District; New York Power Authority in Niagara, New York; Pacific Gas and Electric Company, Sacramento, California; South Carolina Electric and Gas; and the Southern Company in Atlanta, Georgia.

Our work was performed from July 1998 through February 1999 in accordance with generally accepted government auditing standards.

Comments From the Department of Energy



Department of Energy

Power Marketing Liaison Office
Washington, DC 20585

March 16, 1999

Susan D. Kladiva
Associate Director, Energy
Resources, and Science Issues
U.S. General Accounting Office
Washington, D.C. 20548

Dear Ms. Kladiva:

Attached are technical comments of the Southeastern, Southwestern, and Western Area Power Administrations on the General Accounting Office's draft report entitled Federal Power: Implications of Reduced Maintenance and Repairs of the Bureau of Reclamation's and the Corps of Engineers' Hydropower Plants (GAO/RCED-99-63).

We appreciate the opportunity to comment and suggest technical corrections to the draft report.

On matters of a policy nature, we defer to the comments of the Bureau of Reclamation and the Army Corps of Engineers.

Sincerely yours,

A handwritten signature in black ink, appearing to read "T. J. Mecks".

Timothy J. Mecks
Assistant Administrator
For Power Marketing Liaison

On March 6, 1999, the Department of Energy provided technical suggestions for the draft report but deferred to the comments of the Bureau and the Corps on more substantive matters. For example, Energy suggested that we clarify the differences between “reliability” and “availability.” The report already discussed that plants are viewed as reliable, within the electric utility industry, if they can function without failure over a specific period of time or amount of usage. The report also demonstrates that there are several ways of measuring reliability, including the availability factor and outage factors. Accordingly, we made no substantive changes to the report.

Comments From the Department of the Interior

Note: GAO comments supplementing those in the report text appear at the end of this appendix.



United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

MAR 12 1999

Ms. Susan D. Kladiva
Associate Director, Energy,
Resources, and Science Issues
General Accounting Office
441 G Street NW.
Washington, D.C. 20548

Dear Ms. Kladiva:

Enclosed are comments on the draft General Accounting Office report entitled "Federal Power: Implications of Reduced Maintenance and Repairs of the Bureau of Reclamation's and the Corps of Engineers' Hydropower Plants," (GAO/RCED-99-63).

Provided are a number of both general and specific comments that are intended to clarify Reclamation's position regarding reliability measures, operation and maintenance, and funding mechanisms. The report does a good job in recognizing the funding needs of operating and maintaining electrical generating facilities, especially in recognizing the near-term needs for funding when unexpected failures occur. However, the report relies on several key assumptions that result in a misinterpretation of Reclamation's power operations.

The report does not articulate the fact that Reclamation's facilities are, by statute, operated to fulfill multiple purposes including providing water for irrigation, municipal and industrial, fish and wildlife as well as for electricity generation. In operating the plants, Reclamation must balance the competing demands for water rather than maximizing power production. Reclamation's practice has been to try to balance availability with effectiveness. If water is not available for generation, having a unit available has little true worth. Consequently, using the availability factor as a means comparison with other entities who are not operating under these restrictions imposed by multipurpose facilities will give inaccurate results.

The report indicates Reclamation's powerplants are less reliable when compared to the hydropower industry based on availability factors alone. Reclamation has been conducting benchmark studies for several years, in which it has been determined that for multipurpose facilities the forced outage factor is a far more reliable indicator of comparative reliability than is the availability factor. Reclamation's benchmarking comparisons with other hydroelectric producers indicate that Reclamation compares very favorably with the hydroelectric industry in the area of reliability.

See comment 1.

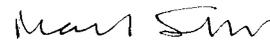
See comment 2.

See comment 3.

**Appendix III
Comments From the Department of the
Interior**

We appreciate the opportunity to review the draft report and draft transmittal letter and to comment on the subject matter. We hope you will find the enclosed comments to be of assistance, and we would be pleased to provide further information or clarification on any of the comments provided.

Sincerely,



 Patricia J. Beneke
Assistant Secretary
for Water and Science

Enclosure

**Appendix III
Comments From the Department of the
Interior**

Bureau of Reclamation
Comments on Draft GAO Report

**Federal Power:
Implications of Reduced Maintenance and Repairs of the
Bureau of Reclamation's and the Corps of Engineers' Hydropower Plants
GAO/RCED-99-63**

General Comments

See cover letter.

1. **Report Focus**: The report does a good job in recognizing the funding needs for operating and maintaining electrical generating facilities, especially in recognizing the near-term needs for funding when unexpected failures occur. Recent agreements, such as the Direct Funding Agreement with the Bonneville Power Administration and direct customer contributions, have provided Reclamation additional tools and fiscal resources to deal with unanticipated failures or other needs. Also, the main body of the report describes the initiatives that Reclamation and the Corps of Engineers took to identify alternative funding sources to ensure that the facilities were adequately maintained. This point is not well articulated in the executive summary.

See cover letter.

2. **Multipurpose Operating Objectives**: The report should recognize that Reclamation's availability factors are, in part, a result of the fact that Reclamation's facilities operate to fulfill multiple purposes, of which power generation is considered secondary to irrigation, flood control, etc. The non-Federal hydroelectric projects that are used for comparison in this report operate to maximize power and maximize revenues. Many of Reclamation's powerplants are located on pipelines, canals, and water diversion facilities as opposed to the "run of the river" operation of most non-Federal plants. This is reflected in Reclamation's lower average plant factor than the industry average.

See cover letter.

3. **Equating Availability with Reliability**: Reliability is a measure of a generator's ability to operate when it is needed, while availability is a measure of a unit's ability to operate within a given time period. These factors can be directly equated only when the unit is required to operate for the full time period. Optimum availability is unique to each plant, depending on design factors; time day, week, and year; water supply; location; cost factors; etc. Availability should not be a fixed target as the report implies. Reclamation's power operation and maintenance practices have tried to balance availability with effectiveness. If water is not available for generation, having a unit available has little true worth. In these cases, we have reduced the cost of maintenance by eliminating overtime and ensuring that required maintenance is performed at a sufficient level to minimize forced outages. Reclamation concurs with the definition of reliability on page 4 of the report that "Plants are 'reliable' if they can function without failure over a specific period of time or amount of usage." Under this definition, the forced-outage factor is a far more reliable indicator of reliability than is availability and allows for a fairer comparison between multipurpose and single purpose power facilities and between generating facilities using different fuel types such as hydropower, coal, natural gas, or nuclear.

4. **Delay of Repairs and Maintenance**. Throughout the report the language used implies that Reclamation delays repair and maintenance activities until funds become available. Statements should be added to indicate that Reclamation performs maintenance and repairs

**Appendix III
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when it becomes necessary and reprioritizes funding for these activities when required. Reclamation delays these activities only when studies or investigations indicate that these activities are not critical and the delay will not impair the reliability of the facility.

5. Highlight Reclamation Power Laboratory/Benchmarking Activities: The report cites that in 1997 Reclamation had an 87-percent availability rating which is an increase from 81 percent in 1993. However, the report fails to mention the significant work that Reclamation has completed, and is doing, to benchmark power operations, not only within Reclamation but also with the industry. Reclamation is continually striving to improve its performance to operate in the most efficient and businesslike manner as is possible given the legal and financial constraints encountered. The report should also acknowledge the work of Reclamation's National Performance Review Power Management Laboratory that was recognized by the Vice President with a *Hammer Award*.

Specific Comments

Now the report cover

1. Page 1: The title of the report makes the incorrect supposition that Reclamation has reduced its operation and maintenance program. Reclamation has always practiced and continues to practice preventive and/or reliability centered maintenance. Reclamation feels that adequate funding was available for operations and maintenance during the report period.

Now on p. 4.

2. Page 2, first paragraph, last sentence: The sentence should read "hydropower plants and transmission system" in place of "hydropower plants" as the Power Marketing Administrations maintain the transmission system but do not maintain powerplants or generate electricity. Also, throughout the report the phrase "PMA's electricity" is used; it is more appropriate to use the term "federally produced electricity."

Now on p. 7.

3. Page 6, first paragraph: The report indicates that forced outages are strong indicators of reliability in mentioning that the Corps of Engineers' forced-outage rate is higher than non-Federal units but omits mentioning that Reclamation's forced outage rate is the same as non-Federal units over the time period discussed.

Now on p. 8.

4. Page 7, Figure 1: When comparing performance factors, it is crucial to ensure that one is comparing like facilities. As discovered with our bench marking studies, facilities of differing types and generating capacities have different operating characteristics. Comparing Federal facilities in total against non-Federal facilities in total may distort the conclusions due to differences in capacity, type, etc. Industry data providers recognize this factor by separating the powerplants into different size categories and unit types (generators and pump-generators).

Now on p. 9.

5. Page 8, second paragraph, last sentence: Although the customers funded up to \$22 million, the rewind contract was awarded for \$ 8.8 million with total replacement costs estimated at \$12.2 million. This cost is under the \$14 million estimated in 1990.

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Now on pp. 10 and 11.

6. Page 10, third paragraph: The paragraph incorrectly states that alternative operation and maintenance funding may diminish the opportunity for congressional oversight. Reclamation negotiated with power customers to retain congressional oversight. Reclamation requires the power customers to commit to a funding level before Reclamation prepares and submits its budget to Congress. This provides the Congress the opportunity to review the actions taken by Reclamation and the power customers before funds are expended.

Now on pp. 28 and 29.

7. Page 27, last paragraph: The statement attributed to Reclamation that “. . . the longer a scheduled outage, the less efficient the maintenance program. . .,” appears to be out of place in this discussion of Federal plants reliability as it would apply only to “run of the river” non-Federal plants. Federal plants are not allowed to earn more revenues, and it would not be applicable in instances where the energy source is unavailable. Outage time ceases to be a factor if water is not available to operate the unit.

Now on p. 30.

8. Page 30, footnote: The term “Western States Coordinating Council” should read “Western Systems Coordinating Council.”

Now on p. 34.

9. Page 36, first paragraph, fifth sentence: The phrase “the other 3 units” should read “the 2 other units” as the total number to be repaired was 3 of the 5 main units at the plant.

Now on p. 36.

10. Page 37, third paragraph: Reclamation’s policy is to not defer critical maintenance. Reclamation does have deferred maintenance of non-critical items. However, unfunded maintenance requirements do not necessarily indicate a deferred maintenance situation.

Now on p. 36.

11. Page 38, first paragraph: After “. . . some of these repairs would likely not have been made under the existing federal planning and budgeting processes,” add “due to limited and declining Federal budgetary resources.”

Now on p. 35.

12. Page 38 second paragraph: The costs for the rewind of the Shasta Units dropped from \$10.5 million (low bid) in 1994 to \$8.8 million (selected option) in 1996. The rewind contract executed in 1996 was to increase the rating to 142 MW per unit versus the higher priced rewind in 1994 for 125 MW per unit. In fact the dollar per megawatt was significantly lower in 1996 compared to that for 1994 (\$21,000/MW and \$28,000/MW respectively). The \$21.5 million commitment includes the replacement of the turbines for the three units which was not included in the earlier cost estimates.

Now on p. 40.

13. Page 43, last paragraph, last sentence: Clarify by revising the statement to read “According to Bureau officials, these funding arrangements were caused by budget cuts during the 1980’s and the need for approximately \$200 million in upcoming power-related maintenance in the near future which would limit the agency’s ability to fund maintenance and repairs in a steady, predictable fashion.”

Now on p. 42.

14. Page 46, third sentence: In the sentence “. . . the Bureau prepares an annual operations and maintenance electricity budget . . .,” delete “electricity.”

Now on p. 42.

15. Page 46, first paragraph: In the statement “The Bureau and Bonneville meet in separate ‘Joint Operating Committees,’” strike the word “separate.”

Now on p. 44.

16. Page 48, second paragraph, last sentence: Change “defer spending” to “reschedule up to \$3 million on repairs at the plant.”

The following are GAO's comments on the Department of the Interior's (including the Bureau of Reclamation's) letter dated March 12, 1999.

GAO's Comments

Interior provided us with comments that were intended to clarify its position regarding reliability measures, operation and maintenance, and funding mechanisms.

1. In its cover letter and general comments, Interior stated that the report does a good job in recognizing the funding needs for operating and maintaining electrical-generating facilities. However, Interior stated the report does not articulate in the executive summary, as it does in the body, the initiatives undertaken by the Bureau and the Corps to identify alternative funding sources. We believe that the executive summary adequately addresses the issue of the initiatives undertaken by the Bureau, the Corps, and the PMAS, particularly as they relate to efforts in the Pacific Northwest. Therefore, we did not revise our report.

2. In its cover letter and in general comments, Interior stated that the report does not articulate the fact that the Bureau's facilities are operated to fulfill multiple purposes, such as providing water for irrigation, municipal and industrial uses, fish and wildlife enhancement, and electricity generation. According to the Bureau, if water is frequently not available for generating electricity, the availability factor is not a good indicator for comparing the reliability of the Bureau's hydropower-generating units with other units that are not operated under multipurpose requirements. Interior also suggested that the nonfederal projects are freer to maximize power and revenues because they are less affected by multiple purposes.

We disagree with the Bureau's position that the report does not recognize that water is used for multiple purposes and affects how electricity is generated. For example, the executive summary recognizes that the Bureau and the Corps generate electricity subject to the use of water for flood control, navigation, irrigation, and other purposes. In addition, the report recognizes, in chapter 2, that the Bureau and other utilities utilize periods of low water and low demand to perform scheduled maintenance and repairs. This would tend to decrease the availability factors of these entities. The report also states that this practice may be regarded as good business practices. We further disagree that the availability factor is not a good basis for comparing the reliability of different projects. The availability factor is a widely accepted measure of reliability that has

validity, as long as it is understood in terms of other factors that affect how plants are operated. Moreover, we disagree that other utilities necessarily operate hydropower plants that are affected less by multiple purposes. In fact, as we have noted previously, for other utilities, the multiple uses of the water are regulated through conditions in the utilities' hydropower-plant-operating licenses, which are issued by the Federal Energy Regulatory Commission.

The Bureau contends that the availability of its plants is affected by the fact that more of the Bureau's plants are located on pipelines, canals, and water diversion facilities than most nonfederal plants. We recognized this point in chapter 2.

3. In the cover letter and in its general comments, Interior stated that the forced outages factor is a better indicator of reliability than the availability factor for multiple purpose facilities. In addition, in its cover letter, Interior indicated that the Bureau's benchmarking studies indicate that its plants compare favorably with other plants in the area of reliability. Regarding forced outages factors, our report recognizes that there are several indicators of reliability and the forced outages factor is one of most meaningful. More generally, we disagree with Interior's conclusion that the Bureau's plants are as reliable as those of other power providers. As shown in chapter 2 of this report, although the Bureau's forced outages factors are on par with those of nonfederal utilities, the Bureau's availability factor is lower, and it has been improving. Moreover, the Bureau's scheduled outages factors are higher than nonfederal utilities.

In its general comments, Interior adds that reliability is a measure of whether a plant can operate when it is needed, while availability is a measure of a unit's ability to operate within a given time period. These factors, stated the Bureau, can be equated only when a plant is required to operate for the full time of the period. The Bureau added that optimum availability is unique to each plant, depending on such factors as design, time, water supply, location, and cost. As stated in our report, reliability is a measure of a plant's ability to operate over a specific period or amount of usage. We further agree that the significance of an availability factor should be understood within the context of various factors, some of which are mentioned by the Bureau. We revised chapter 1 to recognize that assessing the performance of a hydropower plant or unit by examining its availability factor calls for understanding additional variables. We added language to reflect that the availability factor needs to be understood in terms of such factors as the kind of demand the plant meets (e.g., whether

it meets peak demand), the availability of water throughout the year, and the purposes satisfied by the dam and reservoir.

4. According to Interior, the report implies that the Bureau delays repairs and maintenance, pending the availability of funds. The Bureau stated that it performs repairs and maintenance when needed by reprioritizing funds. We revised the report in chapter 3 to recognize the Bureau's statement that it reprioritizes funding. However, the example of the delayed repairs because of delayed funding at the Bureau's Shasta, California, project, illustrates our point that repairs and maintenance are delayed when funds are not forthcoming.

5. Interior stated that the Bureau has undertaken a program to improve its performance by benchmarking its electricity operations against the rest of the industry and is continually striving to improve, given the legal and financial constraints encountered. Our report does not imply that these agencies are operating in an unbusinesslike manner but shows that the Bureau's availability has improved in the face of financial and budgeting constraints. We revised chapter 1 to recognize the Bureau's benchmarking effort.

Specific Comments

1. Interior commented that the title of the report implies that the Bureau has reduced its operation and maintenance program. Interior stated the Bureau has always implemented preventive and reliability-centered maintenance and that adequate funding for these activities has been available. Chapter 4 of the report recognizes that the Bureau, in particular in the Pacific Northwest, will increasingly practice reliability-centered maintenance and practiced preventive maintenance in the past. However, the efforts of the Bureau's field locations to engage in direct or advance funding arrangements serves as evidence that faster and more predictable funding is needed.

2. We added "transmission system" to the report, as requested by Interior.

3. We revised the report to indicate that the Bureau's forced outages rate from 1993 through 1997 was the same as the nonfederal sector's.

4. According to Interior, our comparing plants of different size and type may distort our conclusions about the performance of the federal and nonfederal plants. We disagree. As shown in appendix I, the federal and nonfederal electrical-generating units in our analysis were about same size

because our analysis of nonfederal units excluded about 2,400 smaller ones that averaged about 9 MW of generating capacity. In addition, our decision to include both conventional generators and pump generators in our analysis was based on the fact that the Corps' performance data did not separate its conventional and pump units. The Bureau itself, in its 1996 benchmarking study, included seven pump units (about 323 MW) at its Grand Coulee and Flatiron plants as conventional generating units. Moreover, although the Bureau has generating units from 1 MW to 700 MW, it used only two MW-size categories (1 to 29 MW, and 30 MW and larger) in comparing the availability and outages factors of its plants to the industry in its 1996 benchmarking study. In addition, our analysis of the availability factors of the Bureau's hydropower-generating units from 1993 through 1997 showed that among pump generators as well as the size categories zero to 10 MW, 11 to 50 MW, 51 to 100 MW, and 101 to 200 MW, the Bureau's hydropower units had lower availability factors than the industry as a whole.

5. According to Interior, although the customers funded up to \$22 million in repairs for Shasta, the rewind contract was awarded for \$8.8 million, including total costs to replace the turbines estimated at \$12.2 million. This point is expanded upon under comment 12.

6. Interior disagrees with the statement in the draft report that advance or direct funding arrangements decrease opportunities for congressional oversight. We revised the report to state that, although these arrangements could diminish opportunities for oversight, the Bureau, the Corps, and the PMAS provide such information as the history and background of their power plants; the plants' generating capacity and electricity produced; annual electricity revenues and costs; and related environmental and water availability issues to the Congress, other decisionmakers, and to the public. The means of communicating this information include the PMAS' annual reports; the PMAS', the Bureau's, and the Corps' Internet Websites; and letters to the Congress.

7. According to Interior, our statement that "the longer the scheduled outage, the less efficient the maintenance program," is out of place as it pertains to federal plants. The statement would apply primarily to run-of-the-river plants, according to Interior. The Department noted that federal plants are not allowed to earn more revenues and outages do not have an impact on revenues if water is not available for generating electricity.

We believe our report sufficiently addresses these points. We have already noted that performing scheduled outages during times of low water or low demand may constitute good business practice. In addition, we have noted the need to understand such factors as the kind of demand a plant meets (for instance, whether it meets peak demand) and the availability of water for generating power. Our report also states that, as markets evolve to become more competitive, operating plants at higher availability factors may allow the PMAs and utilities to take advantage of new opportunities to earn revenue by selling ancillary services. In addition, we continue to believe that, all things being equal, having plants on-line for longer periods of time is also good business practice, as stated in the Bureau's 1996 benchmarking report.⁴⁵

8. As suggested by Interior, we revised the report to read "Western Systems Coordinating Council."

9. As suggested by Interior, we revised the report to reflect that three of five units at Shasta were repaired. The other two were not.

10. In response to Interior's comment, we revised the report to reflect that while the Bureau defers noncritical items, it does not defer items it deems to be critical. Interior also notes that unfunded maintenance requirements do not necessarily indicate a deferred maintenance situation. In our view, any maintenance requirements that are put off until the future are deferred. However, we revised the report to state that deferred maintenance is not problematic as long as it can be managed.

11. As requested by Interior, we added "due to limited and declining federal budgetary sources."

12. Interior clarified that the costs of rewinding the Shasta units decreased from \$10.5 million (low bid) in 1994 to \$8.8 million in 1996. The rewind contract was executed in 1996 to increase the rating to 142 MW per unit versus the higher-priced rewind in 1994 to 125 MW per unit. Most importantly, the \$21.5 million commitment includes the replacement of turbines in three units that were not included in earlier cost estimates. Because of the new information provided regarding the nature of the additional work at Shasta, we revised our report in chapter 3 to state that the Bureau expanded the scope of work to be performed at the plant.

⁴⁵See U.S. Bureau of Reclamation, A New Era of Power, Performance, and Progress: Future Generations (1996).

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Comments From the Department of the
Interior

13. As suggested by Interior, we revised the text to state that the funding arrangements in the Pacific Northwest were necessitated by budget cuts during the 1980s. Also, the need to fund about \$200 million in maintenance in the near term would limit the Bureau's ability to pay for maintenance and repairs in a steady, predictable fashion.

14. As suggested by Interior, we deleted the word "electricity" from the reference to the Bureau's operation and maintenance budget.

15. As suggested by Interior, we revised the text to eliminate references to "separate" Joint Operating Committees.

16. As suggested by Interior, we changed "defer spending" to "reschedule."

Comments From the Department of Defense

Note: GAO comments supplementing those in the report text appear at the end of this appendix.



DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

16 MAR 1999

Audit Office

Comptroller General
General Accounting Office
ATTN: Ms. Susan Kladiva
441 G Street, N.S.
Washington, D.C. 20548

Dear Sir:

Attached is a summary of the verbal comments we provided in a meeting at HQUSACE on March 10, 1999, and the agreed upon resolutions.

FOR THE COMMANDER:

Encl


JOHN E. TEMPLETON
Chief, Audit Office

Appendix IV
Comments From the Department of Defense

On March 16, 1999, the Department of Defense (including the Army Corps of Engineers) provided us with a letter acknowledging that the Corps' verbal comments, discussed with us at a March 10, 1999, meeting, had been resolved. The primary verbal comment was that we did not reflect changes in the performance of the Corps' hydropower plants that occurred in fiscal year 1998. The Corps suggested that we include these data in various graphs in our report. As discussed with Corps officials, we addressed the changes in the Corps' performance in the text of our report, primarily in chapter 2. However, we declined to show changes in the graphs because the 1998 data were not available for the nonfederal hydropower generating units at the time we completed our review.

Comments of the Bonneville Power Administration

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

Department of Energy

Bonneville Power Administration
Washington, D.C. 20585

March 11, 1999

In reply refer to: KN

Susan D. Kladiva
Associate Director, Energy Resources, and Science Issues
United States General Accounting Office
441 G Street, NW
Washington DC 20548

Dear Ms. Kladiva:

The Bonneville Power Administration (Bonneville) appreciates the opportunity provided by the General Accounting Office (GAO) to review and provide written comments on the March 1, 1999 Draft Report entitled "FEDERAL POWER: Implications of Reduced Maintenance and Repairs of the Bureau of Reclamation's and the Corps of Engineers' Hydropower Plants" (the Draft Report). In general, Bonneville feels the GAO staff have sought to conduct a fair assessment of the U.S. Army Corps of Engineers (Corps) and the Bureau of Reclamation (Reclamation) facilities during the time of the study. However, additional clarification and explanation of several points is warranted. Bonneville understands the Corps and Reclamation are also providing GAO with their comments. Bonneville would defer to the Corps and Reclamation regarding the interpretation of hydroelectric data.

See comment 1.

Bonneville understands that the GAO was not requested to evaluate the new direct funding agreements between Bonneville the Corps and Reclamation. Bonneville does, however, believe that the systematic planning, budgeting and direct funding processes that have been implemented in the Federal River Power System (FCRPS) and the improved Northwest hydropower availability factors achieved by Reclamation demonstrate how the direct funding agreements can and will continue to provide increased operational capability and value to the Federal Columbia River Power System.

See comment 2.

Because of this view, Bonneville recommends that additional clarification language be added to the section of the Draft Report entitled Pacific Northwest Funding Initiatives Systematic Planning and Budgeting Process. Bonneville recommends that on page 46 of the Draft Report, at line 8, after the sentence ending in "region.", the following language should be added, "The Bonneville/Corps/Reclamation Direct Funding agreements contain a systematic approach to maintenance planning and investment that creates the opportunity for increased hydroelectric availability, financial savings and increased revenues."

Regarding availability factors, specifically for the period of 1993-1997, availability numbers for the Reclamation plants in the Pacific Northwest are cited as being low. However, the reason for this lower availability was not explained. Bonneville believes that the GAO should acknowledge that, during this period, extensive upgrades and rehabs to the Reclamation plants were undertaken, in part as a result of the increased funding flexibility provided by the Bonneville direct funding agreements. Furthermore, on page 4 of the Draft Report, in the Results in Brief section, after the first sentence ending, "hydropower plants.", Bonneville recommends that a statement be added indicating that, "Bonneville, the Corps and

**Appendix V
Comments of the Bonneville Power
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Reclamation recognized the lower reliability of the plants in the Pacific Northwest and took action through a series of Direct Funding agreements to correct the problem.”

The GAO Draft Report (on pages 5, 10, 43 and 50) raises an issue about diminishing the opportunities for Congressional oversight. While it is true that Congressional Appropriations Committees would no longer have to provide appropriations for the Corps and Reclamation power investments and maintenance activities Bonneville is direct funding, those committees have fully supported this change. These agreements have helped to conserve the scarce discretionary budget authority that these Committees allocate each year. Please see pages 70 and 71 of Senate Report No. 105-44 of July 10, 1997 for the Senate Appropriations Committee’s report language in strong support of Bonneville direct funding agreements with the Corps and Reclamation for power operations and maintenance.

Please also see page S. 1190 of the Congressional Record of February 6, 1992 for legislative history on Bonneville direct funding authority. The primary framer of the now enacted legislation is former Oregon Senator Mark Hatfield. In discussing the legislation, Senator Hatfield stated that “More than sufficient congressional oversight is assured because section 11(b) of the FCRTSA [Federal Columbia River Transmission Act] provides that Congress may by appropriation act place limitations on BPA expenditures.” Section 11(b) was retained in law when Bonneville’s direct funding authorities were clarified in Section 2406 of the National Energy Policy Act of 1992 (PL 102-486, 16USC 839d-1).

Bonneville recommends that it should also be noted in the final GAO Report that the annual Bonneville Congressional Budget Submission, which is reviewed by Congress, includes programmatic information on the power capital and operations and maintenance funding Bonneville plans to provide to the Corps and Reclamation for the Federal Columbia River Power System. Implementation of the first direct funding agreement was reported to the Congress in January 1994 when the FY 1995 Bonneville budget discussed the signing of the Bonneville/Reclamation MOA and direct funding for four Reclamation projects. These projects included major rehabilitation of the Minidoka Project, stator rewinds of three generators at Grand Coulee Dam, replacement of 115kv transformers at the Hungry Horse Project and a major overhaul of the original generators at the Boise Diversion Project installed in 1912.

Also, related to Congressional oversight, the GAO draft (on pages 43 and 50) states that these various direct funding mechanisms either may (p. 43) or do limit (p. 50) Congressional flexibility to make tradeoffs among competing needs. Bonneville believes that its direct funding agreements actually provide the Congress with increased funding flexibility. Such long-term agreements both provide (1) additional funding resources to the Corps and Reclamation power activities that would not otherwise be available and (2) Congress with the ability to reallocate to other national priorities the scarce discretionary budget authority available to the Congress.

Bonneville also provides the following additional comments:

- In the section entitled ACTIONS TAKEN TO PROMOTE FASTER AND MORE CERTAIN FUNDING TO BETTER MAINTAIN AND REPAIR FEDERAL FACILITIES, on page 10, line 3 of the Draft Report, after the word “occurs”, adding “than under the traditional appropriations process.”, would make the sentence clearer.

Now on pp. 10,
11, and 45.
See comment 3.

See comment 4.

Now on p. 10.

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Comments of the Bonneville Power
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Now on p. 8.
See comment 5.

Now on p. 9.
See comment 6.

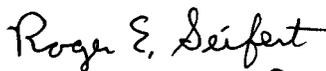
Now on p. 33.
See comment 7.

Now on p. 38.
See comment 8.

- Figure 1 on page 7 of the Draft Report is confusing in its present location and should be moved forward in the discussion. The figure showing national average availability factors is positioned over a discussion about availability in the Pacific Northwest.
- On page 5, line 5, and again on page 9, line 10, the Draft Report indicates that some customers are leaving Bonneville for less expensive sources. This was true for the time period of the referenced GAO study (GAO/AIMD-97-110 and 110A). However, the situation today is significantly different. Bonneville now faces a situation where demand for its electricity products exceeds its supply. Bonneville suggests that the report be updated to reflect this. Bonneville believes that the increased demand for its power products and the improved planning flexibility and increased financial resources provided through the direct funding agreements will improve Bonneville's competitive viability and ability to recover the full cost of the Federal Columbia River Power System (FCRPS).
- Regarding the reliability discussions on pages 5 and 33 of the Draft Report, Bonneville recommends that the final report recognize that for large hydroelectric systems, the ability to generate revenues is dependent on both the availability of water and the availability of operable, generating units. Both conditions and other factors have to be considered in each specific case to determine the optimum maintenance program for the Federal Columbia Rivers Power System multi-program hydroelectric resources.
- Following the discussion on Douglas County Public Utility District at the bottom of page 40 of the Draft Report, Bonneville believes it is appropriate to say that, "Bonneville is achieving a similar effect of being able to quickly provide access to funds and establish reserve funds, through establishment of direct funding agreements with the Corps and Reclamation."

Again, thank you for the opportunity to provide written comments on the Draft Report.

Sincerely,



Stephen J. Wright
Vice President for the
Office of National Relations

for

The following are GAO's comments on the Department of Energy's (including the Bonneville Power Administration's) letter dated March 11, 1999.

GAO's Comments

On March 11, 1999, Bonneville provided us with general and specific comments regarding our draft report. Bonneville noted that in its view, we "sought to conduct a fair assessment of the U.S. Army Corps of Engineers (Corps) and the Bureau of Reclamation (Reclamation) facilities during the time of the study."

1. Bonneville understood that we were not requested to evaluate the direct-funding agreements in the Pacific Northwest. However, Bonneville suggested that we add language to the report to reflect that the funding agreements between itself, the Bureau, and the Corps contain a systematic approach to maintenance planning and investment that creates opportunities for increased hydropower availability, financial savings, and increased revenues. We believe that our report addresses these points. However, we added language that Bonneville believes these enhancements will be attained as a result of the funding agreements.

2. As noted by Bonneville, our report stated that the availability factors of the Bureau's and the Corps' hydropower plants in the Pacific Northwest are lower than in the rest of the nation. Bonneville suggested that we clarify the report, in the executive summary, by stating that Bonneville, the Bureau, and the Corps recognized the lower reliability of the plants in the Pacific Northwest and took action through a series of direct-funding agreements to address the problem. Bonneville further suggested a clarification that during the period 1993 through 1997, the federal agencies undertook extensive upgrades and rehabilitations of the Bureau's plants partly as a result of the increased funding flexibility provided by the direct-funding agreements. We agreed that these statements would clarify the report and incorporated them.

3. Bonneville noted that the draft report stated that funding maintenance and repair actions through direct customer contributions or through direct payments from the PMAS' revenues reduced opportunities for congressional oversight. According to Bonneville, the funding arrangement in the Pacific Northwest was specifically supported by the Senate Appropriations Committee in 1997. Bonneville also stated that its annual congressional budget submission includes programmatic information on the operations and maintenance funding that Bonneville plans to provide for the Bureau

and the Corps. In response to this and other comments, we revised the executive summary and chapter 4 to show that information is now being made available to the Congress and others about the operation of the federal power program. For instance, the Bureau, the Corps, and the PMAS provide such information as the history and background of their power plants; the plants' generating capacity and electricity produced; annual electricity revenues and costs; and related environmental and water quality issues to the Congress, other decisionmakers, and to the public. The means of communicating this information include the PMAS' annual reports; the PMAS', the Bureau's, and the Corps' Internet Websites; and letters to the appropriate congressional committees.

4. We revised the executive summary as recommended by Bonneville by adding "under the traditional appropriations process."

5. Bonneville believed that the location of figure 1 in the executive summary was confusing, since it discussed national availability factors but was positioned over the discussion of availability in the Pacific Northwest. We agree and have relocated the figure.

6. The draft's executive summary stated that some of Bonneville's power customers are leaving the agency for less-expensive sources. Bonneville stated that some customers left the power administration in an earlier period but the situation today is significantly different, with demand for electricity and other products exceeding the supply. Bonneville stated that increasing demand for its electricity as well as the increased financial resources provided by its funding agreements with the Bureau and the Corps will improve its competitive viability and ability to recover the full cost of the Federal Columbia River Power System. We agreed and revised the report in the executive summary and chapter 4.

7. Bonneville suggested that the final report recognize that, for large hydropower systems, the ability to earn electricity revenues depends on the availability of water and of operable hydropower-generating units. These conditions and other factors must be considered to optimize the maintenance program for the plants from which Bonneville markets electricity. We agreed and revised chapter 3 accordingly.

8. As suggested by Bonneville, we added language to chapter 3 to the effect that like the Douglas County Public Utility District, Bonneville will be able to quickly provide access to funds and establish reserved funds through agreements whereby its funds directly pay for the operation,

**Appendix V
Comments of the Bonneville Power
Administration**

maintenance, and repair of the Bureau's and the Corps' hydropower plants.

Major Contributors to This Report

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