Relicensing and Environmental Issues Affecting Hydropower

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Hydropower attracts both support and criticism for its environmental effects. Proponents have argued that unlike fossil-fueled electric power plants, hydroelectric projects do not pollute the air or increase emissions of greenhouse gases. Opponents have countered that hydropower can harm fragile aquatic environments. These environmental concerns affect two prominent issues that could have a major impact on available hydroelectric generating capacity in the next decade. First, many non-Federal hydroelectric units currently or will soon need to be relicensed, which has become more controversial because of the effect hydropower projects can have on aquatic environments. Second, even those facilities that do not have to be relicensed may be affected by legislation regulating water uses and other environmental concerns.

This article presents an overview of the hydropower industry and summarizes two recent events that have greatly influenced relicensing and environmental issues. First, the U.S. Supreme Court's May 1994 Tacoma decision raised fundamental questions about who has the authority to relicense hydroelectric power plants. Second, under the Endangered Species Act, Federal agencies are required to ensure that their actions do not jeopardize protected species and their habitat. The impact of this Act has been particularly significant recently for the federally owned facilities in the Pacific Northwest that are presently under streamflow restrictions aimed at aiding endangered local fish populations.

Industry Overview

General Statistics

In 1994, the hydroelectric power industry, including utility and nonutility facilities, operated around 4,500 units[1] with 75.3 gigawatts of nameplate capacity at conventional facilities and 18.4 gigawatts at pumped storage facilities.[2] The industry supplied 256.9 billion kilowatthours of electricity in 1994, accounting for almost 9 percent of total U.S. annual electricity sales.[3]

Around 64 percent of the total U.S. hydroelectric capacity is concentrated in seven States (Figure FE1), with almost 23 percent in Washington alone. The Pacific Contiguous Region is the only region where hydroelectric generation is the primary source of electricity, with almost 50 percent of the electricity generated by water in 1994.[4] Of the seven States with more than 3 gigawatts of hydroelectric capacity, Virginia and South Carolina are the only two States with more pumped storage capacity than conventional capacity.

The utility net hydroelectric generation share of total utility net generation has been declining for many years

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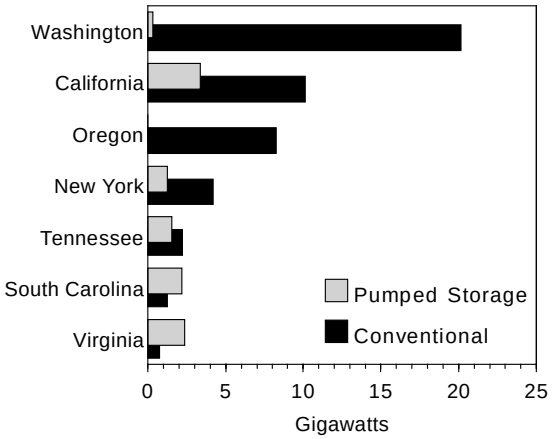
[1]Energy Information Administration, *Inventory of Power Plants in the United States 1994*, DOE/EIA-0095(94) (Washington, DC, September 1995), Table 1, and Energy Information Administration, Form EIA-867, "Annual Nonutility Power Producer Report" (preliminary 1994 data).

[2]Hydroelectric net generation is gross generation minus plant use and includes generation from conventional hydroelectric facilities as well as pumped storage plants. Conventional facilities include storage, run-of-river, and diversion facilities. Pumped storage facilities repeatedly recycle water by pumping water discharged from the turbines to a lower retaining pool back into an upper storage facility for peak power production. Pumped storage facilities have a negative net generation, since the electricity consumed to pump the water exceeds the amount produced. The generation produced at these facilities is used during peak electric demand hours.

[3]Energy Information Administration, *Electric Power Annual 1994 Volume I*, DOE/EIA-0348(94)/1 (Washington, DC, July 1995), Table 1, and Energy Information Administration, Form EIA-867, "Annual Nonutility Power Producer Report" (preliminary 1994 data).

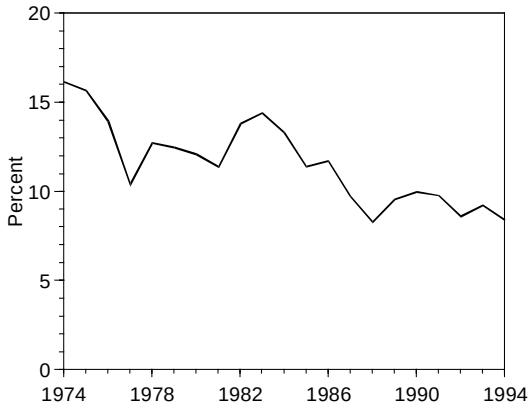
[4]Energy Information Administration, *Electric Power Annual 1994 Volume I*, DOE/EIA-0348(94)/1 (Washington, DC, July 1995), pp. 23-25.

Figure FE1. States with More than 3 Gigawatts of Hydroelectric Capacity, 1994



Note: Includes utility and nonutility.
Source: Energy Information Administration, *Inventory of Power Plants in the United States 1994*, DOE/EIA-0095(94) (Washington, DC, September 1995), Table 17, and Energy Information Administration, Form EIA-867, "Annual Nonutility Power Producer Report" (preliminary 1994 data).

Figure FE2. Utility Hydroelectric Generation Share of Total Utility Generation, 1974-1994



Note: Generation data include output from conventional hydroelectric facilities and pumped storage facilities.
Source: Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(95/08) (Washington, DC, August 1995), Table 7.1.

as generation from other fuels has grown (Figure FE2),[5] particularly coal-fired and nuclear generation.

One of the reasons for this decline is that the average annual growth rate of utility net hydroelectric capability is less than the average annual growth rate for total utility net capability. The average annual growth rate of utility hydroelectric net summer capability was 1.2 percent from 1974 to 1994, while the annual growth rate for total utility net capability reached more than 2.0 percent. Also, the utility hydroelectric capability share of total capability decreased from 16.1 percent in 1974 to 13.7 percent in 1994.[6]

Another reason that the share of net hydroelectric generation has been declining is the addition of more pumped storage hydroelectric facilities. Because net generation from these facilities is negative, total net hydroelectric generation (which includes pumped storage generation) is less than generation from conventional facilities alone. Therefore, as the number of these facilities increases, yearly net hydroelectric generation could show a decrease due to these facilities. In 1994, pumped storage facilities accounted for 20.4 percent of total utility hydroelectric capacity, compared with 14.0 percent in 1974,[7] and totaled a net of -3.4 billion kilowatthours.[8]

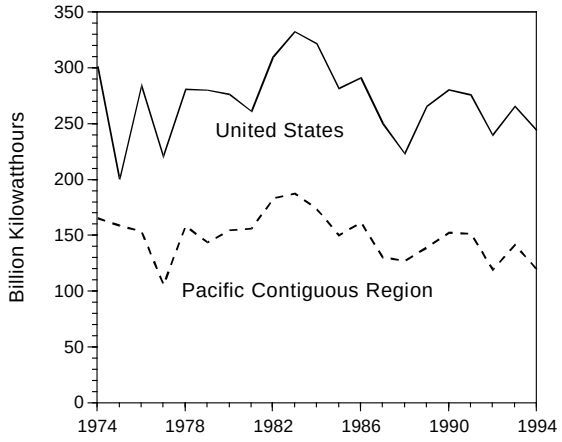
The Relationship Between Hydroelectric Generation and Precipitation

Hydroelectric generation is particularly susceptible to variations in precipitation. During years of a severe drought, or conversely, during years of heavy rainfall, generation from hydroelectric facilities can vary substantially from the average, and the effects of variations in precipitation can linger for many months, even years in some severe cases. For example, average U.S. utility hydroelectric generation over the past 21 years is around 275 billion kilowatthours annually. However, in 1988, utility hydroelectric generation was only 223 billion kilowatthours, while in 1983 generation was more than 332 billion kilowatthours (Figure FE3).

Contributing to particularly low hydroelectric generation in the past few years was a severe drought from the fall of 1986 to spring of 1988 in the Pacific

[5]Data on nonutility facilities are not included in historical data series due to lack of historical data.
[6]Energy Information Administration, *Annual Energy Review 1994*, DOE/EIA-0384(94) (Washington, DC, July 1995), p. 243, and Energy Information Administration, *Inventory of Power Plants in the United States 1994*, DOE/EIA-0095(94) (Washington, DC, September 1995), Table 1.
[7]Energy Information Administration, Form EIA-860, "Annual Electric Generator Report" (1992 and 1994).
[8]Energy Information Administration, *Electric Power Annual 1994 Volume I*, DOE/EIA-0348(94)/1 (Washington, DC, July 1995), Table 1.

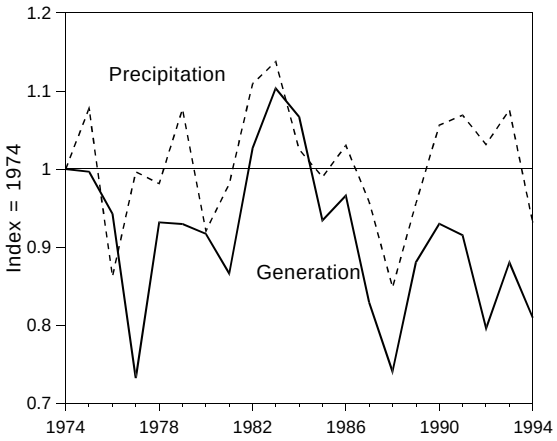
Figure FE3. Utility Hydroelectric Generation in the United States and the Pacific Contiguous Region, 1974-1994



Note: Generation data include output from conventional hydroelectric facilities and pumped storage facilities.

Source: Energy Information Administration, Form EIA-759, "Monthly Power Plant Report," and predecessors (1974-1994).

Figure FE4. Utility Hydroelectric Generation and Average Annual Precipitation, 1974-1994



Notes: •Generation data include output from conventional hydroelectric facilities and pumped storage facilities. •Precipitation data are weighted by area by dividing the area of each State within a region by the total regional area. The national precipitation values were derived by weighting the precipitation values for each of the nine U.S. census regions by area. Data for Hawaii and Alaska are not included in the U.S. precipitation total.

Source: Energy Information Administration, Form EIA-759, "Monthly Power Plant Report," and predecessors (1974-1994), and National Climatic Data Center.

Contiguous Region (Washington, Oregon, and California), followed by several years of below-normal precipitation. More than half of the Nation's conventional utility hydroelectric capacity is located in the Pacific Contiguous Region. Average annual precipitation in the region was below normal[9] from 1987 to 1992,[10] and net regional generation reached a low of 119 billion kilowatthours in 1992 and again in 1994 (Figure FE3). The 10-year average of annual hydroelectric generation in the region prior to 1987 was 157 billion kilowatthours.[11] The Pacific Contiguous Region is still recovering from the effects of the below-normal precipitation levels as ground water levels and reservoir levels improve to normal levels.

Average annual precipitation for 1983 and 1988 was strikingly different in the Pacific Contiguous Region, 41.7 inches in 1983 and 22.6 inches in 1988. Average annual U.S. precipitation also varied with 33.8 inches in 1983 and 25.2 inches in 1988.[12] Generation and precipitation fluctuate in similar patterns (Figure FE4), indicating that variations in generation are related to variations in precipitation.

Relicensing and Hydropower

Non-federally owned hydroelectric capacity must be licensed by the Federal Energy Regulatory Commission (FERC—Figure FE5). More than 24 gigawatts of hydroelectric capacity will need to be relicensed from 1995 to 2010 in order to continue operating (Figure FE6). Because this is almost half of current non-Federal capacity, relicensing has become an important issue in the industry. In May 1994, arguments over environmental considerations resulted in a Supreme Court decision (the Tacoma decision)[13] that raises fundamental questions about who has the authority to relicense hydroelectric power plants.

[9]Normal precipitation is the average precipitation from 1931 to 1987 as published by the National Climatic Data Center, and is 26.9 inches per year in the Pacific Contiguous Region.

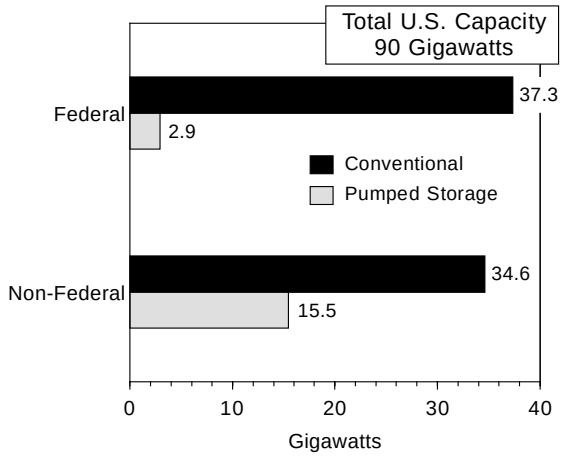
[10]National Climatic Data Center. Precipitation data are weighted by area by dividing the area of each State within a region by the total regional area. The national precipitation values were derived by weighting the precipitation values for each of the nine U.S. census regions by area. Data for Hawaii and Alaska are not included in the U.S. precipitation total.

[11]Energy Information Administration, Form EIA-759, "Monthly Power Plant Report."

[12]National Climatic Data Center.

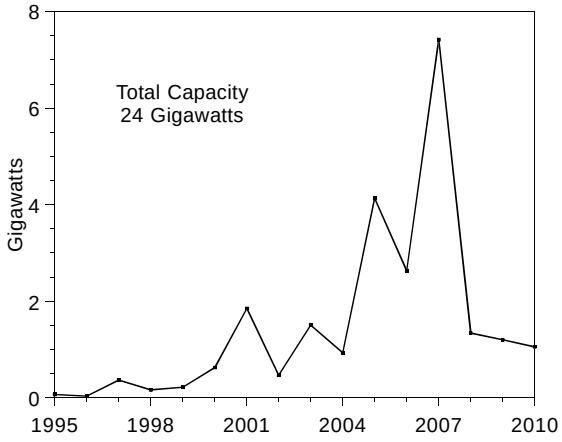
[13]Supreme Court of the United States, PUD No. 1 of Jefferson County et al. v. Washington Department of Ecology et al., No. 92-1911 (May 31, 1994).

Figure FE5. Utility Federal and Non-Federal Hydroelectric Nameplate Capacity, 1994



Source: Energy Information Administration. **Capacity:** Form EIA-860, "Annual Electric Generator Report." **Ownership:** Form EIA-861, "Annual Electric Utility Report."

Figure FE6. Licensed Hydroelectric Capacity by Year of License Expiration, 1995-2010



Source: Federal Energy Regulatory Commission, "Relicense Forecast 1993-2010" (Washington, DC, December 1993), p. 3.

The FERC's Historical Role in Hydropower Relicensing

Historically, the FERC has been the sole body charged with balancing the various environmental and electricity demand considerations in deciding whether to reissue hydroelectric licenses to non-Federal hydropower projects. Prior to the Tacoma decision, the FERC exercised exclusive authority under the Federal Power Act (FPA), as amended by the Electric Consumers Protection Act of 1986, to approve or disapprove non-Federal water power projects on navigable waterways and Federal lands. Under the FPA, the FERC issues licenses for up to 50 years for constructing, operating, and maintaining non-Federal hydropower projects. Upon expiration of a license, the Federal Government can take over the project (with equitable compensation), the FERC can issue a new license to either the existing licensee or a new licensee, or the FERC can order the facility to be dismantled by the existing licensee.

In deciding whether to issue or reissue a license, the FERC is mandated to give equal consideration to a full range of purposes related to the potential value of a stream or river. Environmental, energy, and water supply issues are to be considered as part of the decision process.

To be licensed, the FERC must be satisfied that the project is compatible with a comprehensive plan for developing the waterway. If the FERC is satisfied, a license is issued with conditions relating to environmental and engineering concerns. After a license is issued, the FERC monitors the licensee's compliance with the license conditions throughout the term of the license.[14]

The Tacoma Decision

This authority of the FERC to license hydroelectric projects seems to have been weakened by the Supreme Court in the 7-2 Tacoma decision. This decision, in effect, gave States the authority to set license conditions under the auspices of Section 401 of the Clean Water Act (CWA) that could prevent the FERC from licensing projects, even those projects that are consistent with the comprehensive development standard.

The Case

To better understand the implications of the Supreme Court ruling, it is important to review the history of the Tacoma decision. It began in 1982 when the City of Tacoma, Washington, and the Jefferson County utility district (the petitioners) proposed to build a hydroelectric project along the Dosewallips River. The planned project would have reduced by approximately

[14]Federal Energy Regulatory Commission, *Hydroelectric Project Relicensing Handbook* (Washington, DC, April 1990), pp. 4-5.

20 percent the water flow in the bypassed reach of the River.[15] The petitioners applied to the Washington Department of Ecology (WDE) for a water quality certificate, which was required by Section 401 of the CWA before the license could be issued by the FERC under the FPA. The WDE issued the certification but imposed a number of conditions, including a minimum streamflow requirement[16] of between 100 and 200 cubic feet per second in order to protect the river's fishery.

The petitioners appealed the minimum streamflow requirement, arguing that the CWA is concerned with water quality, not water quantity.[17] They asserted that the CWA draws a sharp distinction between the regulation of *water quantity* and *water quality* and that minimum streamflows imposed by the WDE interfered with the FERC's authority under the FPA. Basically, the petitioners claimed that a conflict existed between the conditions imposed by the WDE and the FERC's authority to license hydroelectric projects under the FPA.[18] Conflicting decisions resulted from the appeals process and the case was eventually decided by the U.S. Supreme Court in May 1994.

The Decision

Essentially, the U.S. Supreme Court's Tacoma decision gives States greater authority under the CWA and broadens the basis for refusal of Section 401 certification of hydropower projects. The Court found that WDE's requirement is a limitation necessary to ensure the designated use of the river as a fish habitat. The Court rejected the petitioners' argument that a State may only impose water quality conditions. The Court found that the petitioners' assertion that the CWA is only concerned with water *quality*, not *quantity*, makes an artificial distinction, since a sufficient lowering of quantity could destroy all of a river's designated uses, and since the CWA recognizes that reduced streamflow can constitute water pollution.[19]

The FERC after the Tacoma Decision

The FERC has attempted to reassert itself on Section 401. In a July 15, 1994, order, the FERC asserted that it can exclude any Section 401 certification condition that is unrelated to water quality.[20] The FERC issued a license to Tunbridge Mill Corporation for a 100-kilowatt project in Vermont. The FERC viewed the order as significant in that it addresses conditions imposed by the State of Vermont that are clearly not related to *water quality* and are therefore outside the scope of Section 401. Vermont had included requirements for State approval of project changes, State approval of the project start date, and State ability to reopen Section 401 certification. The FERC deemed that these three conditions had nothing to do with water quality and therefore they were not included in the license.[21]

Proposal for Change

The 104th Congress is examining the possibility of reauthorizing the Clean Water Act. The U.S. House of Representatives has passed a bill (H.R. 961) that would, in effect, overturn the Tacoma decision and strengthen the FERC's licensing authority. This bill has been sent to the U.S. Senate for its consideration.[22]

The Endangered Species Act and the Columbia River Basin

Another prominent issue facing the hydroelectric power industry stems from the requirements of the Endangered Species Act of 1973. The objective of the Act is to protect plant and animal species whose survival is in jeopardy and, optimally, to restore the species to a self-sustaining state. Concerning Federal agencies, the Act requires that their actions do not jeopardize any protected species or their habitat.[23] Thus, the Act applies to all Federal hydroelectric facilities. Although

[15]Supreme Court of the United States, Syllabus, PUD No. 1 of Jefferson County et al. v. Washington Department of Ecology et al., No. 92-1911, Slip Opinion (May 31, 1994), p. I.

[16]Jim Behnke and Harold Dondis, "The Clean Water Act and Federally Licensed Utilities," *Public Utilities Fortnightly* (November 1, 1994), p. 42.

[17]Jay Manning, "Two Views on the U.S. Supreme Court's Elkhorn Decision: Ramifications for States and the Environment—State Authority Under Section 401," *National Environmental Enforcement Journal* (October 1994), p. 7.

[18]Supreme Court of the United States, Syllabus, PUD No. 1 of Jefferson County et al. v. Washington Department of Ecology et al., No. 92-1911, Slip Opinion (May 31, 1994), p. III.

[19]Supreme Court of the United States, Syllabus, PUD No. 1 of Jefferson County et al. v. Washington Department of Ecology et al., No. 92-1911, Slip Opinion (May 31, 1994), p. III.

[20]George K. Lagassa, "When FERC and States Collide," *Independent Energy* (October 1994), p. 70.

[21]Federal Energy Regulatory Commission, Minutes of 13 July 1994 Meeting (July 15, 1994), p. 2.

[22]*U.S. Water News*, "Senate to Slow Clean Water Act Reform," Vol. 11, No. 12 (June 1995), p. 1.

[23]U.S. General Accounting Office, "Endangered Species: Federal Actions to Protect Sacramento River Salmon," GAO/RCED-94-243 (Washington, DC, August 1994), p. 2.

(Although not discussed in this article, FERC licensed hydroelectric projects must also comply with the Endangered Species Act.)

Almost one-half of the existing hydroelectric capacity is federally owned. Federal hydroelectric dams are located throughout the country but are concentrated geographically in the South and West. These facilities were developed by the Federal Government as multi-purpose water resource projects.

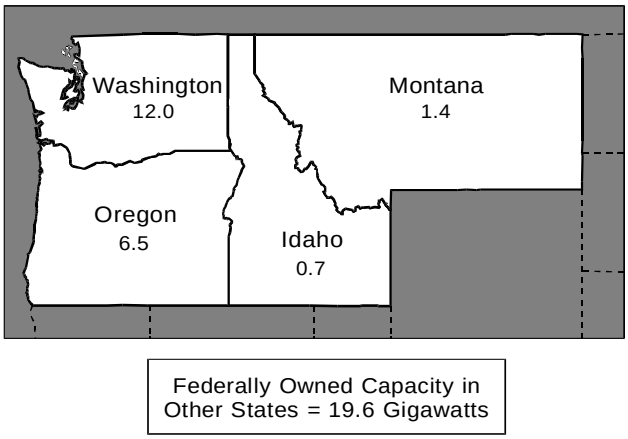
Federal Dams in the Columbia River Basin

The effects of the Endangered Species Act are particularly felt on Federal hydroelectric facilities in the Pacific Northwest. This area contains one of the country's largest water systems—the Columbia River and its major tributary, the Snake River—located in the States of Washington, Oregon, Idaho, and Montana. These four States contain 51.3 percent of the Nation's Federal hydroelectric nameplate capacity (Figure FE7) and 36.6 percent of the Nation's total hydroelectric nameplate capacity. Along with power generation, the Columbia River has many other uses, including flood control, irrigation, water supply, navigation, recreation, and a fish and wildlife habitat. All of these uses must be managed together in order to maintain the system.

There are 30 federally owned hydroelectric projects in the Columbia River Basin, as well as 26 major non-Federal U.S. hydroelectric projects, that are over 100 megawatts in size.[24] Two government organizations play a part in the management of the Federal hydroelectric dams—the U.S. Army Corps of Engineers (USCE) and the U.S. Bureau of Reclamation (USBR). Throughout the Pacific Northwest, the Bonneville Power Administration (BPA) has the responsibility for marketing power from the Federal facilities, and the USCE and the USBR operate the facilities.

Many of these Federal dams were built years ago—some the result of President Franklin Roosevelt's New Deal—with the latest beginning operation in 1975.[25] Additional generating units were added to some of the dams in later years. These dams supply numerous customers, including 11 aluminum smelters that account for close to half of the Nation's aluminum production,[26] and have historically provided electricity at some of the Nation's lowest rates, roughly one-third of electricity prices in the most expensive areas of the country.[27]

Figure FE7. Federally Owned Nameplate Capacity in the Pacific Northwest by State, 1994
(Gigawatts)



Source: Energy Information Administration. **Capacity:** Form EIA-860, "Annual Electric Generator Report." **Ownership:** Form EIA-861, "Annual Electric Utility Report."

Threatened or Endangered Species

Salmon and steelhead runs in the basin have decreased from an estimated 11 to 16 million fish a year in pre-colonial times to around 2 million fish a year today.[28] Three stocks of salmon that populate the Columbia River Basin have recently been listed as threatened or endangered species. Efforts to preserve these listed stocks are causing changes in operation of the dams on the Columbia and Snake Rivers. In 1983, the Northwest Power Planning Council, created by Congress in 1980 to develop a program to protect the local fish and wildlife, requested the BPA to provide more water to aid salmon migration.

In the Columbia River Basin, the National Marine Fisheries Service (NMFS) has taken the lead for the implementation of the Endangered Species Act as it applies to anadromous fish, that is, fish that migrate up

[24]Bonneville Power Administration, "Multipurpose Dams of the Pacific Northwest" (July 1990).
[25]Bonneville Power Administration, "Multipurpose Dams of the Pacific Northwest" (July 1990).
[26]*The Seattle Times*, "What Cost to Save Snake River Sockeye" (March 20, 1995), p. A1.
[27]Energy Information Administration, *State Energy Price and Expenditure Report 1992*, DOE/EIA-0376(92) (Washington, DC, December 1994), p. 18.
[28]*The Washington Post*, "Northwest Salmon Plan Is Outlined" (January 26, 1995), and *Los Angeles Times*, "Hydropower Changes Offered to Save Salmon" (January 26, 1995).

river from the sea to breed in fresh water. In 1992 and again in 1993, the NMFS stated in its Biological Opinion that the operation of Federal dams on the Columbia River, with changes, did not jeopardize the endangered salmon. The Idaho Department of Fish and Game disagreed and filed a suit in 1993 against the NMFS, the USBR, and the USCE, to stop Federal agencies from operating the Columbia River dams in ways that they believed jeopardize the salmon.[29] A Federal judge ruled in March 1994 that the NMFS had violated the Endangered Species Act in 1993 when it determined that dam operations were not jeopardizing the endangered salmon, and the judge ordered the NMFS to develop a new Biological Opinion for operation of the hydrosystem.[30]

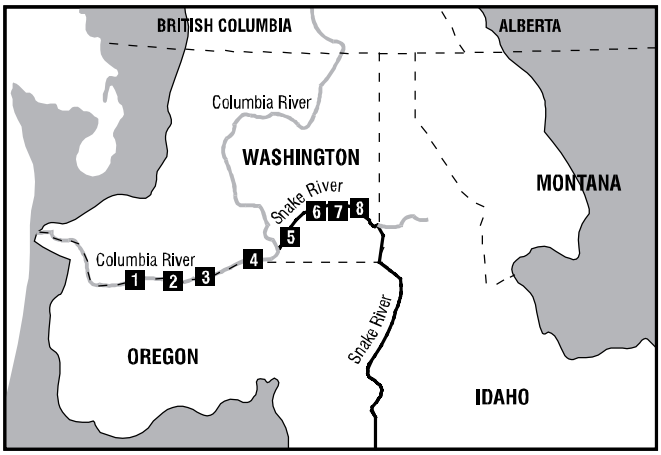
In 1994, the USCE dramatically increased flow augmentation and water spills over eight major dams in the basin. Spilling water means that the water cannot be used to generate electricity, but, in theory, improves juvenile fish passage and survival past the dams by allowing more fish to pass over the spillway instead of through the turbines. Increased water flow in the rivers theoretically aids the salmon populations by speeding young salmon on to the Pacific Ocean.

Providing the spring and summer flow augmentation for fish passage can cause unseasonal drawdowns of up-river storage reservoirs to provide the needed water. This generally occurs in years of below-normal water flow levels. Because the increased water flow is necessary in the spring, water available for hydroelectric generation during peak electricity demand seasons (usually during the winter) is decreased, costing BPA millions of dollars in lost revenues and purchase power costs, and any additional generation in the spring from the increased water flow is marketed at cheaper rates. Additionally, spring reservoir drawdowns decrease the flexibility of the system to follow load. The eight dams in question are located on the lower Columbia and Snake Rivers. Various parties believe that these eight dams have been particularly harmful to the salmon (Figure FE8).

In early 1995, the NMFS released a new Biological Opinion. This Opinion differed dramatically from the previous ones. A statement prepared by the NMFS[31] states that while previous Opinions allocated "...a specific volume of water to be released in the spring for fish...", the operation plan "...still allowed significant drawdown of reservoirs in winter for power production." The 1995 Biological Opinion, however, differs.

> "It calls for major U.S. storage reservoirs to be as full as possible on April 15, within flood control requirements. Winter drawdown for power production would be allowed only if reservoirs can be recovered by April 15 with a high degree of confidence."

Figure FE8. The Columbia River Basin



Eight Dams Targeted by Major Streamflow Regulations, 1994

Plant Name	Capacity (megawatts)
1. Bonneville	1,093
2. The Dalles	1,820
3. John Day	2,160
4. McNary	991
5. Ice Harbor	603
6. Lower Monumental	810
7. Little Goose	810
8. Lower Granite	810

Source: **Map:** Bonneville Power Administration, "Columbia River System Operation Review: Draft Environmental Impact Statement" (July 1994), p. 3. **Capacity:** Energy Information Administration, *Inventory of Power Plants in the United States 1994*, DOE/EIA-0095(94) (Washington, DC, September 1995), Table 20.

[29]*Utility Environment Report*, "Idaho Dept. of Fish and Game Files Suit to Stop Dam Operations that Harm Fish" (October 1, 1993), p. 11.

[30]*Utility Environment Report*, "Federal Judge Rules NMFS' 1993 Hydro Dam Decision Violated Endangered Species Act" (April 1, 1994), p. 1.

[31]The National Marine Fisheries Service, "Statement of How 1995 Biological Opinion Impacts Differ from Previous Opinions" (1995).

Prior to this Opinion, fish and power were intended to receive equal consideration. Now, the fish are considered prior to power, with only flood control before fish in priority.

The Statement prepared by NMFS also presents the following statistics.

> "If the 1995 Opinion restrictions had been in effect from 1992-94, between 13 million and 16 million acre-feet of water would have been dedicated for salmon. This range represents the equivalent of 80 percent to 95 percent of the total U.S. reservoir storage."

Large industrial users of hydroelectricity call the plan too expensive, while conservationists claim the plan does not do enough for the fish.

Costs of Recovery

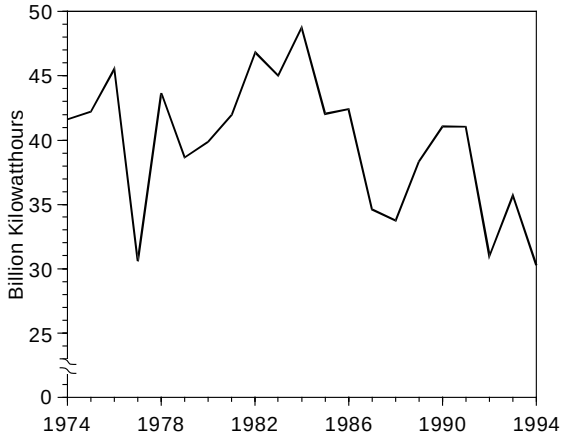
The BPA's estimated cost for fish protection is projected to be about half a billion dollars per year.[32] The BPA has had to raise its rates to cover the costs of aiding certain species of salmon that breed in the Columbia and Snake Rivers. As a result, the BPA is faced with the possibility of losing some of its larger industrial customers, as well as some of its utility customers, to other suppliers. Two aluminum companies that had been BPA customers for 50 years, along with an Oregon utility, canceled purchases of 200 megawatts of electricity in May 1995. Those sales were worth $20 million annually to the BPA.[33] Other industrials want to negotiate new contracts with the BPA that would allow them access to the electricity market. Currently, contracts require the companies to purchase their electricity from the BPA only, although the BPA can be used as a broker.[34] The BPA's electricity is currently among the most expensive in the area, and other utilities generating natural-gas-fired electricity are underselling the BPA.[35]

The BPA is proposing an interim 1-year, 4-percent surcharge to be added to electricity prices, effective October 1, 1995, mainly to pay salmon recovery costs.[36] This proposal is accompanied by a proposal for 5-year rates at competitive market prices to begin October 1, 1996. President Clinton has also agreed that the Federal Government will cover some of the cost of the fish expenses.

Effects on Generation

It is expected that there will be less generation from the eight dams shown in Figure FE8 because of the increased environmental measures. The actual amount of the decrease has not yet been determined. It is also expected that seasonal patterns of generation will shift as more water flow is necessary in the spring. Historically, generation from the eight dams has shown a definite decrease since the mid-1980's (Figure FE9). This decrease could have been caused by several factors. First, a severe drought in the region that began in the mid-1980's had a significant effect on generation in the area. As mentioned earlier, the effects of abnormal precipitation levels can linger for many months; however, each of the eight plants in discussion here are run-of-river facilities with only limited storage. Therefore, the abnormal precipitation would presumably have less lingering effects. If generation at the plants is divided by the average precipitation in Washington State for each year, a downward trend in generation is no longer visible (Figure FE10). Therefore, it seems reasonable to attribute some or all of the decrease over the past decade to abnormal precipitation levels.

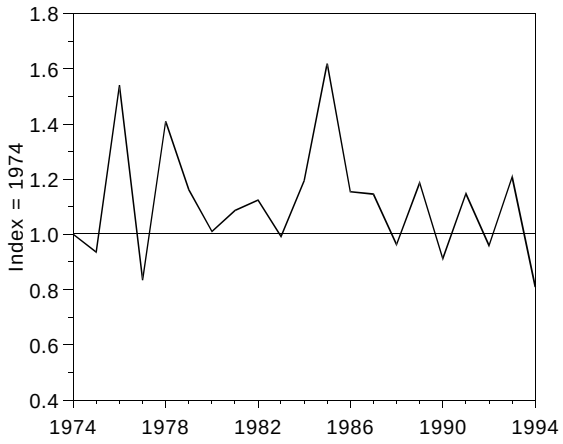
Figure FE9. Hydroelectric Generation at Selected Dams, 1974-1994



Note: Lower Granite began operation in 1975.
Source: Energy Information Administration, Form EIA-759, "Monthly Power Plant Report."

[32]*Electric Utility Week*, "Clinton Agrees to Cover $70-Million in BPA Fish Expenses for Two Years" (March 20, 1995), p. 13.
[33]*The Economist*, "Electricity in the West: Add Salmon to the Bill" (July 15th-21st, 1995), pp. 19-20.
[34]*Electric Utility Week*, "BPA to Delay New Rates Until December, May Set Back Signing of Power Deals" (February 6, 1995), pp. 13-14.
[35]*The Economist*, "Electricity in the West: Add Salmon to the Bill" (July 15th-21st, 1995), pp. 19-20.
[36]*Electric Utility Week*, "In Exchange for 4% Hike, BPA to Allow Customers to Buy 470 MW Off-System" (March 27, 1995), pp. 13-14.

Figure FE10. Hydroelectric Generation at Selected Dams Divided by Average Annual Precipitation, 1974-1994



Notes: •Precipitation data are for Washington State only. •Lower Granite began operation in 1975.

Source: Energy Information Administration, Form EIA-759, "Monthly Power Plant Report," and National Climatic Data Center.

There are other factors, however, that could cause decreased generation. One such factor is conservation. The BPA has taken conservation measures in the form of demand-side management programs. These programs are designed to decrease electricity demand or shift demand from peak times of the day. The end result is less demand, and thus less electricity needs to be generated. These programs allow the BPA to delay new capacity additions.

Finally, some effect on generation probably came from the environmental regulations. While not clearly discernable in annual statistics so far, changes to generation from the dams are expected within the next few years because of the new Biological Opinion provided by the NMFS in 1995. Changes may also be visible in up-river storage reservoirs if drawdowns are necessary to provide the required water flow.

Proposal for Change

Legislation has been proposed that would ease the restrictions of the Endangered Species Act on hydroelectric dams and other industries.[37] The proposed legislation includes a requirement that an economic analysis be performed of the effects on the local economy of proposed restrictions due to endangered species.

Outlook

Current long-term projections for hydroelectric generation show an increase in generation from current levels. Following the below-average 1994 total of 256.9 billion kilowatthours of generation at both utility and nonutility facilities,[38] generation forecasts for 2000 and 2010 are 305.6 billion kilowatthours and 308.8 billion kilowatthours, respectively.[39] These projections assume normal water conditions, compared with 1994 when many areas of the country were experiencing below-normal water conditions. Also, these projections include net capability additions of more than four gigawatts by 2010, including almost one gigawatt of pumped storage capability.[40] Some industry specialists, however, argue that there will be no capacity additions because of the increased competition in the electricity market from low-cost, gas-fired turbines and uncertainties in the relicensing process.

Hydroelectric power, as it has in the past, will continue to be a significant player in the electric power industry. However, there remain many challenges ahead as environmental and legal issues are played out. FERC versus State authority continues to be defined, and a balance between hydroelectricity and wildlife continues to be sought. The future of the industry will be greatly affected by these issues.

[37]*Chemical & Engineering News*, "GOP Senators Target Environmental Rules" (January 30, 1995), pp. 8-9.

[38]Energy Information Administration, *Electric Power Annual 1994 Volume I*, DOE/EIA-0348(94)/1 (Washington, DC, July 1995), Table 1, and Energy Information Administration, Form EIA-867, "Annual Nonutility Power Producer Report" (preliminary 1994 data).

[39]Energy Information Administration, *Annual Energy Outlook 1995*, DOE/EIA-0383(95) (Washington, DC, January 1995), Reference Case: Tables A8 and A17.

[40]Energy Information Administration, *Annual Energy Outlook 1995*, DOE/EIA-0383(95) (Washington, DC, January 1995), Reference Case: Tables A9 and A17.