



The State of the Columbia River Basin



Northwest **Power** and **Conservation** Council
FISCAL YEAR 2016 ANNUAL REPORT

To Congress and Citizens of the Pacific Northwest
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Committee on Energy and Natural Resources
United States Senate

Committee on Energy and Commerce
United States House of Representatives

and

Committee on Natural Resources
United States House of Representatives

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The Northwest Power and Conservation Council was established pursuant to the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Public Law 96-501) by the states of Idaho, Montana, Oregon, and Washington. The Act authorized the Council to serve as a comprehensive planning agency for energy policy and fish and wildlife policy in the Columbia River Basin and to inform the public about energy and fish and wildlife issues and involve the public in decision-making.

This annual report has been developed pursuant to Section 4(h)(12)(A) of the Northwest Power Act. The Council's bylaws, which include its organizational structure, practices, and procedures, are available to the public at www.nwcouncil.org/about/policies/bylaws.

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February 2017

To members of Congress and citizens of the Pacific Northwest:

In 2016, the Council adopted its Seventh Northwest Power Plan, which demonstrates that all, or nearly all, of the new demand for electricity over the next 20 years can be met with low-cost, zero-carbon, energy efficiency improvements. Together, the power plan and 2014 Columbia River Basin Fish and Wildlife Program continue the Council's 35-year history of steadily improving the efficiency of the regional power system while also improving the survival of fish and wildlife in the mainstem Columbia and Snake rivers and their tributaries.

Thanks to the prescience of the 1980 Northwest Power Act, our region has acquired nearly 6,000 average megawatts of cost-effective electric energy efficiency, which is enough saved power to meet the demand of five cities the size of Seattle. That's a staggering amount of inexpensive power that the Council identified in its current and previous six power plans. And thanks to the 1980 Act, these wise investments by the Bonneville Power Administration and the region's electric utilities save electricity consumers more than \$4 billion a year.

Energy efficiency has been the region's second largest energy source since 2012, and we expect it to keep growing. The Seventh Power plan sets a course for the region to acquire another 4,300 average megawatts of cost-effective energy efficiency over the next 20 years. While hydropower is the region's largest and most important energy resource, additional investments in energy efficiency and renewable energy will ensure that the Northwest power system remains the cleanest and most economical in the nation for years to come.

The Council also continues its efforts to protect fish and wildlife affected by the Columbia River Basin hydropower system. We worked hard on a number of initiatives in 2016, including efforts to prevent the introduction of invasive quagga and zebra mussels into the basin, and to prevent the spread of northern pike, another invasive species. Together with our partners including federal and state agencies, Indian tribes, watershed organizations, electric utilities, and others, we are working to protect the incredible natural legacy of the Columbia River Basin. We greatly appreciate your interest and support.

Stephen L. Crow,
Executive Director

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Energy, Fish, Wildlife: The State of the Columbia River Basin

Every global climate model downscaled for the Pacific Northwest indicates that the region will become warmer in the future, with perhaps more rain and less snow.

That is not a good future for a region where the signature fish are cold-water species like salmon and steelhead and hydropower provides half of the electricity. Cold-water species struggle in warm rivers, and snowpack is the fuel supply for hydropower.

In 2016, natural events and the work of the Northwest Power and Conservation Council helped show the region how to prepare for such a future while protecting fish and wildlife, satisfying applicable carbon dioxide reduction requirements, and assuring the region an economical and reliable electrical power supply for the future.

It was a year that began with fresh memories of a devastating summer heat wave and drought in 2015 that killed sturgeon, steelhead, and salmon – including a quarter million sockeye – in the Columbia River. At the same time, Columbia River flows dropped to just 69 percent of normal with a concurrent decline in hydropower. And it also was the year the Council adopted its Seventh Northwest Power Plan, which demonstrates that all, or nearly all, of the new demand for electricity over the next 20 years can be met with zero-carbon, low-cost energy efficiency.

Together, the Council's power plan and Columbia River Basin fish and wildlife program anticipate the challenges of a warming climate by continuing our 35-year history

of steadily improving the efficiency of the regional power system and improving the survival of fish and wildlife in the mainstem Columbia and Snake rivers and their tributaries. In this regard, the summer of 2015 was not so much a wake-up call for the Council as it was a reminder of the prescience of the Northwest Power Act of 1980 in setting a course for the Northwest toward cleaner energy and improved environmental quality.

The Power Act made energy efficiency the primary resource to meet future demand for power. For several reasons it is a good resource for the Northwest, especially in the face of a warming climate. It is significantly lower cost compared to other energy resources, and it does not consume a fuel or release emissions. Since the early 1980s, the region has improved the efficiency of electricity use by an amount equivalent to the power demand of five Seattles today. The Seventh Power plan sets a course for the region to acquire almost that much more efficiency over the next 20 years at a cost that is, again, a bargain for consumers.

In the power plan, the Council recognizes that 1) long-term increases in temperature will alter electricity demand and change precipitation patterns, river flows and hydroelectric generation, and 2) policies enacted to reduce greenhouse gases will affect future power

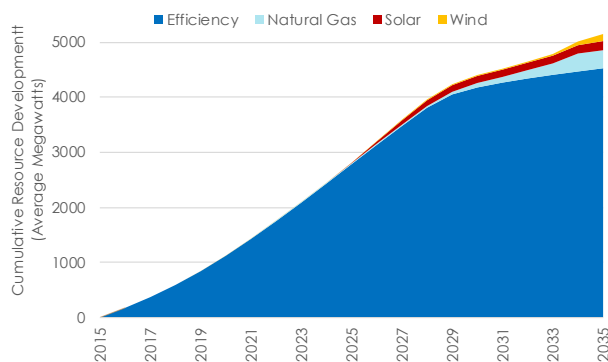




Fish ladder, Bonneville Dam, Oregon

resource choices. The resource portfolio of the plan – the resources the Council finds will meet future demand for power affordably and reliably – includes energy efficiency, demand response, renewable energy, and greater use of existing natural gas-fired plants, which will limit the need for new power plants. The anticipated additional contribution by existing gas-fired plants to the regional power supply, and that of new generating plants in areas with rapid demand growth, is important in light of the planned retirements of four coal-fired generators (two in Washington, one in Oregon, and one in Nevada) by 2022. According to a Council analysis, the region will need nearly 1,400 megawatts of new power-generating capacity to keep the likelihood of a power shortfall to 5 percent or less, which is the Council’s standard for power supply adequacy.

Here is a graphic illustration of the resource portfolio in the Seventh Power Plan:



In addition to accounting for potential future changes in hydropower generation and rules regulating carbon dioxide, the Seventh Plan also accounts for other energy developments in the Northwest such as the steady increase in the number of electric vehicles, a trend the Council expects will continue. The Council has been following and assessing the advent of electric vehicles and their benefits for consumers, utilities, and the environment for six years, and the trends are encouraging. Electric vehicles will reduce carbon emissions from the transportation sector of the economy, reduce the cost of driving for consumers, and create new revenue for utilities through battery charging.

The plan also encourages research in advanced technologies to improve the efficiency and reliability

of the power system, including emerging smart-grid technologies that could make it possible for consumers to help balance their electricity supply and demand and help integrate electric vehicles with the power system. The plan also encourages research in other resources with potential, including distributed solar generation with on-site storage, geothermal, ocean waves, advanced small modular nuclear reactors, emerging energy efficiency technologies, and new methods to store electric power, such as pumped storage and advanced battery technologies.

Meanwhile, in the 2014 Fish and Wildlife Program, the Council acknowledges and addresses the impacts of a warming climate on fish and wildlife in a number of ways including 1) supporting the development of improved methods, techniques, and instrumentation for forecasting runoff and water temperatures in Columbia River Basin watersheds; 2) encouraging federal agencies to evaluate ways to use the dams and their storage reservoirs to create or protect cool-water habitat for fish; and 3) requiring sponsors of projects that implement the program to consider and plan for different climate-change scenarios that could affect their work.

If the Northwest climate steadily warms as anticipated in the downscaled climate models, the Council’s mandate in the Power Act to protect and enhance fish and wildlife affected by hydropower while assuring the Northwest a reliable, low cost – including environmental cost – electricity supply will become ever more important. Protecting cold-water habitat for fish and cooling rivers with deep-water releases from storage reservoirs may be critical to the survival of cold-water species like salmon, steelhead, and bull trout. At the same time, low carbon (natural gas) and zero-carbon (hydropower, wind power, demand response, energy efficiency) resources will increase in importance as a means of contributing to global cooperation to combat climate change.

These challenges are uniquely suited to the Northwest Power and Conservation Council. Together with our partners including dam operators, fish and wildlife agencies, Indian tribes, watershed organizations, electric utilities, and others, we are well under way to improving the supply of clean, affordable, efficient, and reliable energy in the Pacific Northwest while also protecting and

restoring fish and wildlife in the Columbia River Basin, including threatened and endangered species.

Background

The Northwest Power Act

The Council was authorized by Congress in 1980 in the Pacific Northwest Electric Power Planning and Conservation Act (the Power Act), giving the states of Idaho, Montana, Oregon, and Washington a greater voice in how we plan our energy future and protect our fish and wildlife resources. The Act gives the four Northwest states a formal role in making decisions about the allocation of new energy resources for the region.

In the late 1960s and early 1970s, the years leading up to the congressional debate over the Act, the Bonneville Power Administration and many of the region's utilities

were concerned that the region's expected growth would outstrip the power system's ability to meet electricity demand. As a result, Northwest utilities made decisions to build a number of new energy plants, including five nuclear power plants in the state of Washington. When the Act was passed in late 1980, many in the region had come to realize that those earlier decisions, based in part on inaccurate electricity load forecasts, were a disastrous mistake. Only one of the plants, the currently operating Columbia Generating Station, was completed. Due to exorbitant cost overruns, the other four plants were abandoned or mothballed prior to completion. Two of the unfinished plants were responsible for one of the largest bond defaults in the history of the nation, while the financing for the other three plants was backed by the Bonneville Power Administration. Even today, 35 years after the Northwest Power Act was enacted, Bonneville pays millions of dollars a year on debt service



Powerhouse 3 at Grand Coulee Dam, photo courtesy of Tony Grover

for two of the unfinished nuclear plants, plus the one that was completed. And, from 1978 to 1984, Bonneville was forced to raise its rates by 418 percent (adjusted for inflation) to pay for the cost of the three plants.

Congress concluded that an independent agency, controlled by the states and without a vested interest in selling electricity, should be responsible for forecasting the region's electricity load growth and helping determine which resources should be built. The Council does that in the Northwest Power Plan. The Act directs the Council to revise the plan at least every five years. The Act also directs the Council to ensure widespread public involvement in formulating regional fish and wildlife and energy policies.

The Northwest Power and Conservation Council

The governors of Idaho, Montana, Oregon, and Washington each appoint two members to the Council. The eight-member Council sets policy and provides overall leadership for Council activities.

The Council's work is performed, depending on the tasks, by the Council's professional staff (including staff in a central office in Portland and in each state), consultants under contract, or by public agencies and Indian tribes under intergovernmental agreements. The Council's executive director is responsible for coordinating with the Council, supervising the central office staff, administering contracts, and overseeing the day-to-day operations of the Council. The Council approves major contracts and the overall work plan. The Council has 59 full-time-equivalent employees.

The central staff is organized into five divisions: Power; Fish and Wildlife; Public Affairs; Legal; and Administrative. Professional staff in each state provide technical review and assistance to Council members in evaluating matters before the Council. State staff also participate in designing and developing public-involvement programs that focus on the implementation of the Power Plan and Fish and Wildlife Program in their particular states. This support is provided through

existing state agencies or by individuals directly under Council member direction.

The Council, known until 2003 as the Northwest Power Planning Council, is an interstate compact agency authorized by Congress in the 1980 Power Act and created by the legislatures of Idaho, Montana, Oregon, and Washington. The Council's first meeting was in April 1981.

The Northwest Power Act gives the Council three distinct responsibilities: 1) to assure the region an adequate, efficient, economical, and reliable electric power supply; 2) to prepare a program to protect, mitigate, and enhance fish and wildlife, and related spawning grounds and habitat, of the Columbia River Basin affected by the development and operation of any hydroelectric project on the Columbia River and its tributaries; and 3) to inform the Pacific Northwest public regarding these issues and involve them in decision-making. This annual report is organized around the Council's three key responsibilities.

The Power Act created a special relationship between the Council and the federal agencies that regulate and operate dams in the Columbia River Basin and sell the electricity that is generated. The administrator of the Bonneville Power Administration, the federal power marketing agency that sells the output of the Federal Columbia River Power System (a system that includes 29 federal dams within the basin and two outside (in southern Oregon), and one non-federal nuclear power plant), is required to make decisions in a manner consistent with the Council's Northwest Power Plan and its Columbia River Basin Fish and Wildlife Program. Other federal agencies with responsibilities for Columbia River Basin dams (the U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, and Federal Energy Regulatory Commission) are required to take the Council's Power Plan and Fish and Wildlife Program into account "at every relevant stage of decision-making to the fullest extent practicable," in the words of the Act.

Despite its relationship to federal agencies, the Council is not a federal agency and its employees are not federal employees. The eight-member Council consists of two

members from each state, appointed by their respective governors. The Council headquarters are in Portland.

The Columbia River Basin Fish and Wildlife Program

A key element of the Northwest Power Plan is a program to protect, mitigate, and enhance fish and wildlife, and related spawning grounds and habitat, of the Columbia River Basin that have been affected by hydropower dams – federal and privately owned. Consistent with direction in the Act, at least every five years the Council revises the fish and wildlife program, followed by the power plan. That sequence is because the Act requires the Council to include measures in the program to improve survival of anadromous fish – those that are born in freshwater, spend most of their lives in the ocean, and then return to freshwater to spawn – at and between dams on the Columbia and Snake rivers. Because these measures can take water away from hydropower generation – by spilling over dams, for example – the Council anticipates that hydropower generation will be reduced

in a similar manner to past power plans as the result of implementation of the program. This loss is made up by resources included in the plan, primarily investments in energy efficiency.

The Act directs the Council to develop its program and make periodic major revisions by first requesting recommendations from the region’s federal and state fish and wildlife agencies, Indian tribes within the basin, and other interested parties. The Council also takes comment from designated entities and the public on those recommendations.

The Council then issues a draft amended program, initiating a public comment period on the recommendations and proposed program amendments that includes extensive written comments, public hearings in each of the four states, and consultations with interested parties. After closing the comment period and following a review and deliberation period, the Council adopts the revised program. The Council develops its final program on the basis of the amendment



Columbia River, photo courtesy of Tony Grover

recommendations, information submitted in support of the recommendations, views and information obtained through public comment and participation, and consultation with the fish and wildlife agencies, tribes, Bonneville customers and others. The program amendments are not concluded until the Council adopts written findings as part of the program explaining its basis for adopting or not adopting program amendment recommendations.

The program is implemented through projects financed by the Bonneville Power Administration and undertaken by federal agencies including the U.S. Army Corps of Engineers, the Bureau of Reclamation, the Federal Energy Regulatory Commission and its licensees, and by state fish and wildlife agencies, Indian tribes, and occasionally private contractors. Every project proposed to the Council to implement the program is reviewed by the 11-member Independent Scientific Review Panel to be sure it is based on sound scientific principles and is consistent with the Power Act.

The Northwest Power Plan

Following final approval of the fish and wildlife program, the Council revises the power plan. The plan is a 20-year blueprint to meet future demand for power that includes an electricity demand forecast, electricity and natural gas price forecasts, an assessment of the amount of cost-effective energy efficiency that can be acquired over the

life of the plan, and a least-cost generating resources portfolio. The plan guides Bonneville's decision-making to meet its customers' electricity load requirements and also serves as a useful guide for investor-owned utilities in their own least-cost planning.

In the Northwest Power Act, a law that was ahead of its time, Congress concluded that energy efficiency should be the priority energy resource for meeting the region's future load growth. The Act includes a provision that directs the Council to give priority to cost-effective energy efficiency, followed by cost-effective renewable resources. In effect, for the first time, energy efficiency was deemed to be a legitimate source of energy on par with generating resources.

The rest is history. Since the release of the Council's first Northwest Power Plan in 1983, the region's utilities have acquired the equivalent of nearly 5,800 average megawatts of electricity, enough savings to power five cities the size of Seattle.

During the roughly two years after the revision of the power plan and the beginning of work on the next fish and wildlife program, the Council and its staff monitor implementation of the two planning documents, meet with energy and fish and wildlife experts to discuss contemporary issues, and assess progress toward goals in the plan and program.



Sandhill cranes, photo courtesy of Tony Grover



Council Energy Overview

The Seventh Northwest Power Plan

In the Seventh Northwest Power Plan, the Council addresses a host of uncertainties confronting the region's electric utilities and the Bonneville Power Administration, from compliance with federal carbon dioxide emissions regulations to future fuel prices, resource retirements, salmon recovery actions, economic growth, a growing need to meet peak demand, and how increasing renewable resources affect the regional power system. The Council adopted the Seventh Plan in February 2016 following more than a year of work. The plan's resource strategy provides guidance to the Bonneville Power Administration and regional utilities on resource development to minimize the costs and risks of the future power system over the next 20 years.

Pacific Northwest regional loads are expected to increase by between 1,800 and 4,400 average megawatts between 2015 and 2035 before accounting for the impact of the cost-effective energy efficiency called for in the Seventh Power Plan. This translates to an average increase of between 90-220 average megawatts per year, or a growth rate of between 0.4 - 0.95 percent per year. The regional peak load for power, which typically occurs in winter, is forecast to grow from about 30,000 - 31,000 megawatts in 2015 to around 31,900-35,800 megawatts by 2035.

This equates to an average annual growth rate of between 0.3 - 0.8 percent.

Residential and commercial sectors account for much of the growth in demand. Contributing to this growth is increasing air conditioning load, new data centers, and growth in indoor agriculture. Also, summer peak electricity use is expected to grow more rapidly than annual energy demand.

While the Council recognizes that its regionwide perspective and recommendations will differ from those of some individual utilities in the region, in general one resource stands out as the best one to meet most if not all of the region's future demand for power: energy efficiency. In the Council's modeling, energy efficiency consistently proved the least expensive and least economically risky resource. In more than 90 percent of future conditions, cost-effective efficiency met all electricity load growth through 2030 and in more than half of the futures energy efficiency met all load growth for the next 20 years. It's not only the single largest contributor to meeting the region's future electricity needs; it's also the single largest source of new peaking capacity.

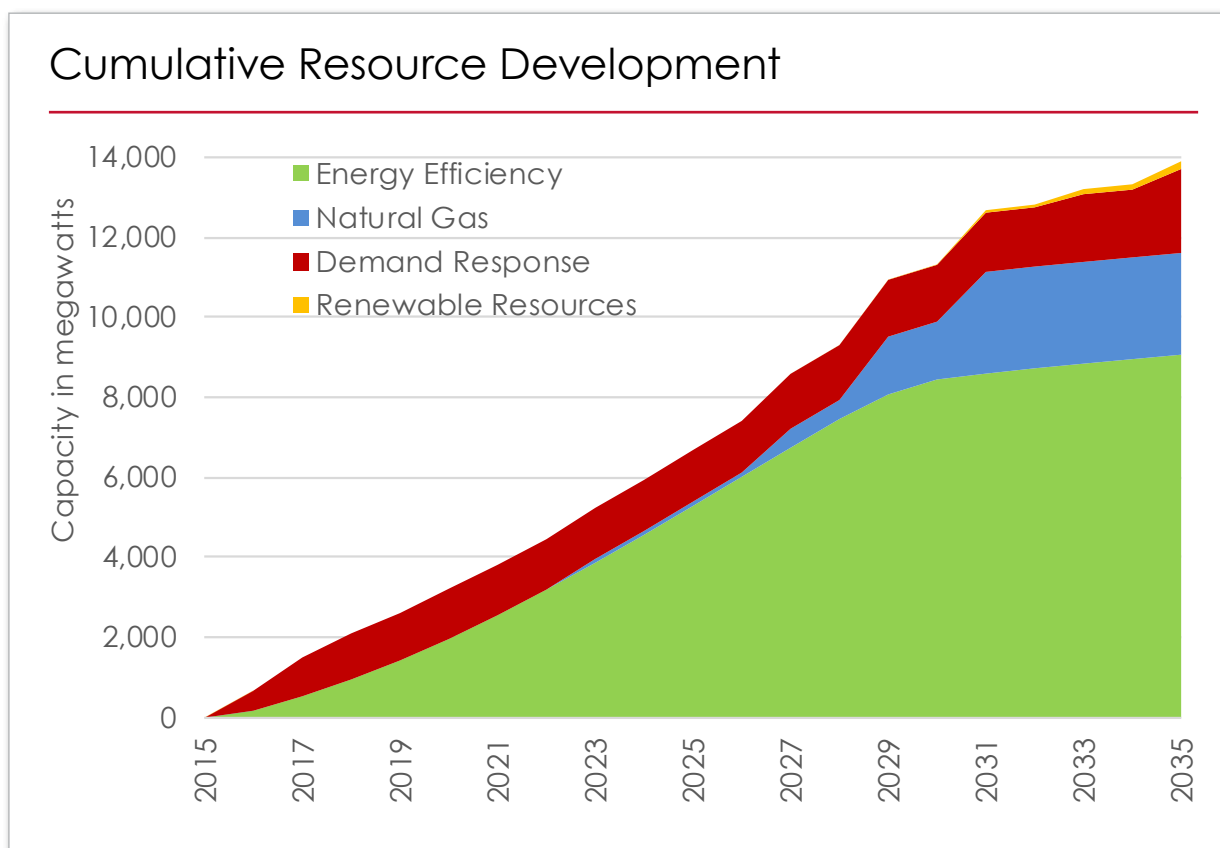
The Seventh Plan calls for aggressively developing energy efficiency with a goal of acquiring 1,400 average megawatts by 2021; 3,000 average megawatts by 2026; and 4,300 average megawatts by 2035. Acquiring this

energy efficiency is the primary action in the plan for the next six years.

The plan’s second priority is to develop the capability to deploy demand response resources or rely on increased market imports to meet system capacity needs under critical water and weather conditions. Demand response is a voluntary reduction in power use – usually for compensation – during periods of peak demand. While the region’s hydroelectric system has long provided

resources and natural gas-fired power. The Council’s assessment identified more than 4,300 megawatts of regional demand response potential. A significant amount of this potential, more than 1,500 megawatts, is available at relatively low cost – under \$25 per kilowatt of peak capacity per year.

As shown in the figure, after energy efficiency and demand response, new natural gas-fired generation is the most cost-effective resource option for the region



ample peaking capacity, it’s likely that under low water and extreme weather conditions we’ll need additional peaking capacity to maintain system adequacy. Because the probability of such events is low but real, demand response resources, which have low development and “holding” costs, are best-suited to meet this need. The value of demand response to help meet capacity needs is illustrated in the figure above, which shows the build-out of resources to meet anticipated demand in the Seventh Power Plan. Energy efficiency and demand response are the least-cost resources to meet capacity needs, along with smaller amounts of renewable

in the near-term. Similarly, after energy efficiency, the increased use of existing natural gas generation offers the lowest cost option for reducing regional carbon emissions. Combined with investments in renewable generation, as required by state renewable portfolio standards, improved efficiency, demand response resources, and natural gas generation are the principal components of the plan’s resource portfolio.

A key question for the plan was how the region could lower power system carbon dioxide emissions and at what costs. The Council’s modeling found that without additional carbon control policies, carbon dioxide



emissions from the Northwest power system are forecast to decrease from about 54 million metric tons in 2015 to around 34 million metric tons in 2035, the result of the announced retirements of coal-fired power plants in Centralia, Washington; Boardman, Oregon; and North Valmy, Nevada, between 2020 and 2026. Existing natural gas-fired generation would replace the output of the three plants, though as noted above, new natural gas-fired generating plants also may be needed to meet specific utility needs. Additionally, about 4,300 average megawatts of energy efficiency would be developed by 2035. The Council expects this combination of resources would meet nearly all forecast load growth over that time frame.

In these circumstances, the region, as a whole, will be able to comply with the Environmental Protection Agency's (EPA's) carbon emissions limits, even under critical water conditions in the Columbia River Basin. However, since the Council did not evaluate compliance with the EPA's carbon emissions limits at the state level, individual Northwest states, especially Montana, may need to take additional actions to comply with these new emissions limits.

The Seventh Plan also recommends investments to add high-voltage transmission capability and improve operational agreements. These investments are important for the region, both to access growing site-based renewable energy and to better integrate low and zero-emissions resources into the existing power system. The Council also expects that there are small-scale resources available at the local level in the form of cogeneration or renewable energy opportunities. The plan encourages investment in these resources when cost-effective.

The plan also encourages research in advanced technologies to improve the efficiency and reliability of the power system. For example, emerging smart-grid technologies could make it possible for consumers to help balance supply and demand. Providing information and tools to consumers to adjust electricity use in response to available supplies and costs would enhance the capacity and flexibility of the power system. Smart-grid development could also help integrate electric vehicles with the power system to aid in balancing the system and reduce carbon emissions in the transportation sector. Research on how distributed solar

generation with on-site storage might affect system load shape is also encouraged in the plan.

Other resources with potential, given advances in technology, include geothermal, ocean waves, advanced small modular nuclear reactors, and emerging energy efficiency technologies. New methods to store electric power, such as pumped storage or advanced battery technologies may enhance the value of existing variable generation like wind.

Resource strategy

Here is a brief look at the resource strategy in the Seventh Plan:

- Develop energy efficiency to meet these targets
 - 1,400 average megawatts by 2021
 - 3,100 average megawatts by 2026
 - 4,500 average megawatts by 2035
- Expand the use of demand response
 - Be prepared to develop a significant quantity of demand response resources by 2021
 - Review resource adequacy assessment assumptions regarding limits to relying on external market supply
- Develop renewable resources
 - Develop those that are cost-effective now.
 - Encourage research on and demonstration of renewable energy with a more consistent output like geothermal or wave energy
 - No need to develop new renewables to meet federal carbon standards at the regional level; new renewable resources should not be seen as an element of a regional least cost resource strategy
- Natural gas
 - Increase use of existing gas generation to offset coal plant retirements
 - Low probability of regional need for new gas-fired generation prior to 2021

- Individual utility circumstances and need for capacity and other ancillary services may dictate development
- Regional resource use
 - Continue to improve system scheduling and operating procedures across the region's balancing authorities to maximize cost-effectiveness and minimize the need for new resources to integrate renewable generation
 - Reducing regional exports in order to serve in-region energy and capacity demand lowers total system cost and the need to develop new generating resources
- Expand resource alternatives
 - Energy efficiency
 - Renewables with less variable output (e.g., enhanced geothermal, wave)
- Adaptive management
 - The Council will annually assess the adequacy of the regional power system to guard against power shortages. Through this process, the Council will be able to identify when conditions differ significantly from planning assumptions so the region can respond appropriately

Exploring the regional value of electric vehicles

The Council is exploring the benefits and impacts to the regional electricity system from the growing number of electric vehicles. Benefits include improving the regional economy, reducing carbon dioxide emissions, helping advance new and emerging technologies, and increasing revenue to electric utilities from charging vehicles. Building infrastructure to support the increase in electric vehicles will be expensive, but the cost is justified by the benefits to consumers, utilities, and the environment.

In its Seventh Northwest Power Plan (2016), the Council predicts electric vehicles will consume about 506 average megawatts of electricity by 2035, an amount

equal to about half the current annual power demand of Seattle, compared to about 17 average megawatts today. Over the same time period the analysis suggests revenue to electric utilities from electric vehicle charging will increase to \$309 million per year from about \$10 million today. The Council has been reporting on the advent of electric vehicles for the past six years.

The Council's current analysis, updated in July 2016, finds:

- Investing in electric vehicle infrastructure is a cost-effective strategy to reduce carbon dioxide emissions from the transportation sector of the regional economy, amounting to more than 42 million metric tons between 2015 and 2035
- After 2035, electric vehicles could continue to reduce regional carbon dioxide emissions by 4 million metric tons annually
- The levelized cost of this carbon reduction over the 20-year planning horizon is about \$31 per metric ton
- A conservative estimate shows by 2035 we could keep \$2 billion dollars per year in the region; the main savings comes from reducing the amount of gasoline that is purchased from producers outside the region
- Electric vehicles could reduce regional transportation costs by \$3-5 billion per year, compared to the cost of operating vehicles with internal combustion engines
- The cost of building the charging infrastructure to support the anticipated number of electric vehicles is about \$3 billion over the next 20 years, but the economic and environmental benefits justify that investment in our generating and transmission systems

Solar power is growing in the Northwest

The cost of solar power has decreased dramatically, helping to spur its growth in the Northwest. Improving

technologies have made installations more efficient, productive, and durable, while incentives from state legislation and the federal Clean Power Plan have also encouraged development. Further proof of this is in the Council's Seventh Power Plan, where for the first time, solar photovoltaic power was assessed to be cost-competitive with wind and natural gas resources.

While there has been substantial solar development nationwide over the past five years – and in particular in sunny states like Arizona and California – the Pacific Northwest has seen limited development until now. That's about to change with the introduction of several utility-scale solar photovoltaic projects in Southern Idaho and Southeastern Oregon. Idaho Power Company projects that over 300 megawatts of solar capacity will come online in its service territory by the end of the year. Considering that the largest project currently operating in the Pacific Northwest is the 5-megawatt Outback Solar in Christmas Valley, Oregon, these new installations, which will add several hundred megawatts to the regional power system, promise to be a valuable learning opportunity.

Utility-scale projects get the headlines, but small rooftop residential and commercial solar installations have been steadily increasing their presence in the market as customers seek energy independence, or, for social economic reasons, “green” energy. For electricity consumers unable to install their own panels – due to location, renting a property, or the high cost of installing small systems – community solar projects are

emerging as an appealing alternative. Either owned and maintained by a utility or a third party (who then sells the power to a utility), customers are able to buy a panel or share in a larger installation, making solar an affordable option and enabling them to access the social and financial benefits of the project.

What's next for solar? Will it continue to grow and mature in the industry and form a presence in the Pacific Northwest? All signs seemingly point to yes. In late 2015, Congress approved an extension to the federal Investment Tax Credit, extending lucrative financial incentives to developers through 2022. And new data is emerging that shows operating solar projects are meeting their pre-development performance goals – a good sign that suggests with continued innovations in technology, solar performance and reliability will only improve. Over the past decade, the region has witnessed the arrival of wind power as over 8,500 megawatts of capacity was developed and installed. The region likely will not see a solar boom to that degree; however, the timing is once again aligning for the next round of renewable power development. While many regional utilities comply with state renewable-energy targets through the early 2020s, they may look to take advantage of the extended tax incentives and develop or secure renewable energy credits from projects sooner rather than later.



Solar farm in southern Idaho alfalfa field, photo courtesy of Tony Grover

The effect of California's renewable power development on the Northwest

California, with one of the most ambitious renewable power programs in the country, increased its renewable portfolio standard (RPS) in September 2015 from 33 percent to 50 percent by the end of 2030. The legislation to increase the state's RPS also made it possible for outside parties to participate in its electricity market, and several Northwest investor-owned utilities announced their intention to do that.

Solar power generation, in particular, has flourished in California. Grid operator data shows that solar generation can be as much as 19 percent of California's electricity supply on a typical afternoon. Large-scale solar projects from utilities grew to about 7,000 megawatts in 2015, while rooftop panels on houses and businesses now supply as much as 3,000 megawatts, according to the Federal Energy Regulatory Commission.

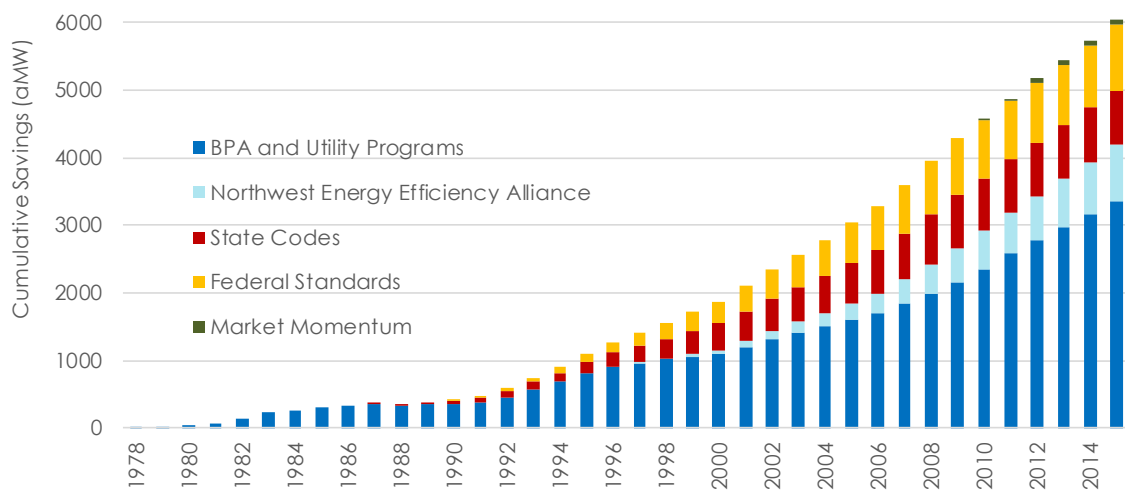
This huge amount of renewable generation has prompted concern about how to balance the interconnected western power system. The concern is that over time, as more renewable power, primarily solar, is added to the power grid and demand for electricity does not grow, there could be times of power oversupply especially during the afternoon hours when solar power is most productive. This could cause system instabilities and would put downward pressure on wholesale market prices. Then in the evening as the solar generation rapidly declines, replacement power would have to ramp up quickly to meet demand and to keep the system stable and reliable.

This situation could create an opportunity for increased exports of power from the Northwest during the ramp-up periods. The Council is tracking several ongoing studies to better understand potential impacts in the Northwest.

Energy efficiency

Energy efficiency, which means using electricity more efficiently, is the second-largest energy resource in the Pacific Northwest, and has been since 2012. Energy

Since 1978 the region has developed around 6,000 aMW of savings



efficiency is a desirable power resource for a number of reasons, such as its low cost compared to generating resources, zero fuel cost, and zero emissions.

Today, efficiency comprises 17.4 percent of the region's energy supply. Hydropower is the top resource, at 46 percent.

In the Seventh Northwest Power Plan (2016), the Council modeled future electricity demand and resources to meet that demand. The modeling tested how well different resources would perform under a wide range of future conditions. Energy efficiency consistently proved the least expensive and least economically risky resource. In more than 90 percent of future conditions, cost-effective efficiency met all electricity load growth through 2030, and in more than half of the futures all load growth for the next 20 years.

In the plan, energy efficiency is not only the single largest contributor to meeting the region's future electricity needs, it's also the single largest source of new peaking capacity. If developed aggressively, in combination with past efficiency acquisition, the energy efficiency resource could approach the size of the regional hydroelectric system's firm energy output, adding to the Northwest's heritage of clean and affordable power.

Energy use becomes more efficient through the installation or application of measures, which range across the entire spectrum of electricity uses in homes, businesses and industries – from motors, compressors, and pumps to lamps, energy controls, refrigerators and freezers, heating and cooling systems, and so on. The Regional Technical Forum (see below) maintains a list of current measures on its website, rtf.nwccouncil.org.

Regional Technical Forum: Independent judgment on energy-saving measures

In order to ensure that energy efficiency measures deliver their anticipated benefits, the Council and the Bonneville Power Administration created the Regional Technical Forum (RTF) 17 years ago. With energy

efficiency continuing as the primary resource to meet future demand for power, the role of the RTF remains as important today as it was at the beginning.

The Northwest has a long history of regional collaboration around power planning and promoting energy efficiency as a resource. In the 1980s, many of the region's programs were designed and evaluated at the Bonneville Power Administration. In the mid-1990s, there was a shift toward a decentralized approach, the rationale being that each market and utility service territory was unique, and this would allow utilities to develop their own programs better tailored to their needs. With the benefits of flexibility, however, came concerns that a decentralized approach might reduce the ability to reliably and consistently quantify this resource. Out of this need, the Council and Bonneville created the RTF to fill that role for the region.

The RTF comprises 30 experts with a variety of backgrounds, including energy-efficiency program planning, implementation, and evaluation. As a body, the RTF weighs facts and provides independent judgment on how much a utility can count on measures to reliably save energy. Having this group of outside experts analyzing data and making judgments on reliability eases the conversation between regulators and utilities. Regulators like it when utilities use RTF values, and utilities save money because the RTF simplifies the evaluation of measures.

The RTF isn't a replacement for research. When the RTF determines that more data are needed to develop a reliable estimate, it identifies the data needs to guide future research. Ideally, this will lead to leveraging research from an individual utility to inform the regional estimate, helping limited research dollars go farther.

Since 1978, the Northwest has saved around 6,000 average megawatts – enough to power five Seattles – meeting 57 percent of the region's load growth over that period. Today, energy efficiency is our region's second-largest power supply behind only hydropower. As new opportunities to save energy emerge, the RTF will help ensure that we're accurately counting those savings.

Council Fish & Wildlife Overview

The Columbia River Basin Fish and Wildlife Program

Developing a cost-savings process to fund emerging program priorities

In the 2014 Fish and Wildlife Program, one of the Council's investment strategies is to work in partnership with Bonneville to find cost savings that will "assure funding for identified program priorities to maximize the biological response resulting from ratepayer and cost-shared investments."

Principles to guide this cost-savings identification effort include:

1. Cost savings efforts will not impact any existing settlement agreements or Columbia River Fish Accords between Bonneville and its partners
2. Cost savings efforts will not affect the legal defensibility of the Federal Columbia River Power System Biological Opinions or Bonneville's Endangered Species Act obligations
3. Projects that are not required by the Accords or Biological Opinions will not be unfairly burdened by any cost-savings efforts

4. Bonneville will not overspend its fiscal year budget to fund emerging program priorities
5. Any proposal to target savings from existing projects should be directed toward:
 - Projects that are closing out
 - Projects that receive unfavorable scientific or Council review
 - Efficiencies achieved within existing projects or programs
 - Cost savings efforts that have a reasonable lead time to ensure smart close out, appropriate budget planning, and to allow sponsors to transition

Council and Bonneville staff set a target of identifying cost savings equal to approximately 1 percent of the program planning budget for Fiscal Year 2017 and also identify program savings for Fiscal Year 2016.

Ensuring long-term maintenance of past program investments

The 2014 Program includes a strategy for future investments that gives highest priority to long-term maintenance of infrastructure that helps implement the program. Adequate funding for operation and maintenance will ensure that existing program-funded infrastructure remains properly functioning and will not only continue



Burns-Paiute fish day, photo courtesy of Tony Grover

to benefit fish and wildlife in the basin, but also help Bonneville meet its mitigation requirements. Several types of program-funded projects require a long-term financial maintenance plan to ensure their longevity and integrity, including fish screens, fishways and traps, hatcheries, and lands.

Since the adoption of the 2014 Program, the Council and Bonneville staff have been working with the Operations and Maintenance Subcommittee, the Independent Economic Analysis Board (IEAB), the Fish Screening Oversight Committee (FSOC), state and federal fish and wildlife managers, and two consulting firms to develop a long-term strategic plan to ensure the longevity and integrity of past investments. Issues the committee is addressing include 1) the importance of regular maintenance; 2) public and fish and wildlife manager review of past investments; 3) incorporation of decommissioning costs as part of the long-term plan; 4) the need to identify the party or parties responsible for operations and maintenance; and 5) which operations and maintenance costs Bonneville is required to fund and which can be shifted to other entities.

The first phase of the four-phase strategic plan development identifies 23 artificial production projects for review. The second phase, which began in 2016, engages

a consulting firm to conduct assessments of the projects, which support 14 separate artificial production programs run by tribes and fish and wildlife agencies. Phase 3 will address prioritization of future investments, and Phase 4 will comprise the final plan.

Focusing on “critical uncertainties” in a new research plan

The 2014 Fish and Wildlife Program describes how the Council will develop a new research plan by working with regional managers, independent science panels, and Bonneville. It also states (Page 104) that “The review will begin with an update of how previous research funds were allocated to particular categories and critical uncertainties.” The Council plans to update the research plan every three years. Each step of these updates will include opportunities for public input.

Key to updating the research plan is understanding of how well projects that implement the program are addressing “critical uncertainties” identified in the program. These uncertainties, which provide focus for research projects, were identified and ranked by the Council’s Independent Scientific Advisory Board and Independent Scientific Review Panel. In the program, these uncertainties are arranged by theme and assigned priorities. The themes are: climate change; contaminants; fish propagation; habitat

(estuary, near-shore plume, ocean, mainstem rivers, and tributaries); harvest; human development; hydrosystem flow and passage operations; monitoring and evaluation methods; non-native species; fish population structure and diversity; fish abundance and the food web; predation; and public engagement.

The program has included a research plan since 2006. In the decade since then, most of the research funded by Bonneville through the Council's program has been directed at understanding the effects of fish propagation activities, followed by tributary habitat restoration and hydrosystem flow and passage operations. The Council estimates more than \$1 billion was spent on research, monitoring, and evaluation activities between 2004 and 2016.

Studying salmon reintroduction above Chief Joseph and Grand Coulee dams

The Council's 2014 Fish and Wildlife Program contains a strategy to study the reintroduction of anadromous fish into areas blocked by dams, notably the area upstream of Chief Joseph and Grand Coulee dams to mainstem Columbia River reaches and tributaries in the United States. The program measure lays out a phased, scientific approach to investigate the feasibility of reintroduction including. Phase 1 includes the task of evaluating the suitability of habitat above the two dams to support anadromous fish. The Council issued a request for proposals and then chose the Spokane Tribe of Indians to conduct the habitat feasibility study, which is expected to be completed in 2017.

Phase 1 also includes a task to identify and evaluate the current methods and emerging technologies of various fish-passage systems used either at high-head dams or those that could be applied to dams of any size and capacity. The Council is preparing a paper on the topic. After a public comment period in the fall, the Council issued the paper in late 2016.

Bonneville Power Administration costs to implement the program

The Council reports annually to the four Northwest governors on costs of the Bonneville Power Administration for fish and wildlife mitigation, including implementation of the Council's fish and wildlife program.

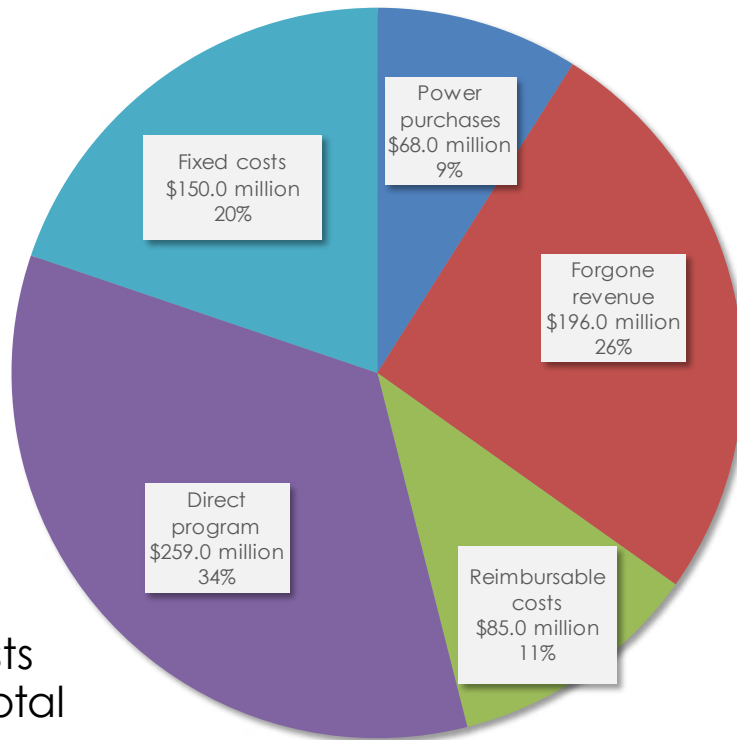
However, as is the Council's practice in these annual reports to Congress, we include a synopsis of Bonneville's costs in the previous fiscal year – the same information we reported to the Governors. The Council issued its 2015 Columbia River Basin Fish and Wildlife Costs Report in June 2016. In Fiscal Year 2015, Bonneville reported total fish and wildlife costs of approximately \$757 million. In the report, the Council expressed these costs as a percentage of total power-related costs – 33.3 percent including forgone hydropower revenues, which Bonneville's Fish and Wildlife Division considers part of the total (a forgone opportunity cost that results from spilling water away from turbines to assist juvenile salmon and steelhead migration to the ocean in the spring and summer), and 24.5 percent as reported by Bonneville's Power Business Line, which does not consider forgone revenue a cost. See next page for two views of these costs from the Council's 2015 costs report.

In Fiscal Year 2015, Bonneville reported total fish and wildlife costs of approximately \$757 million, as follows:

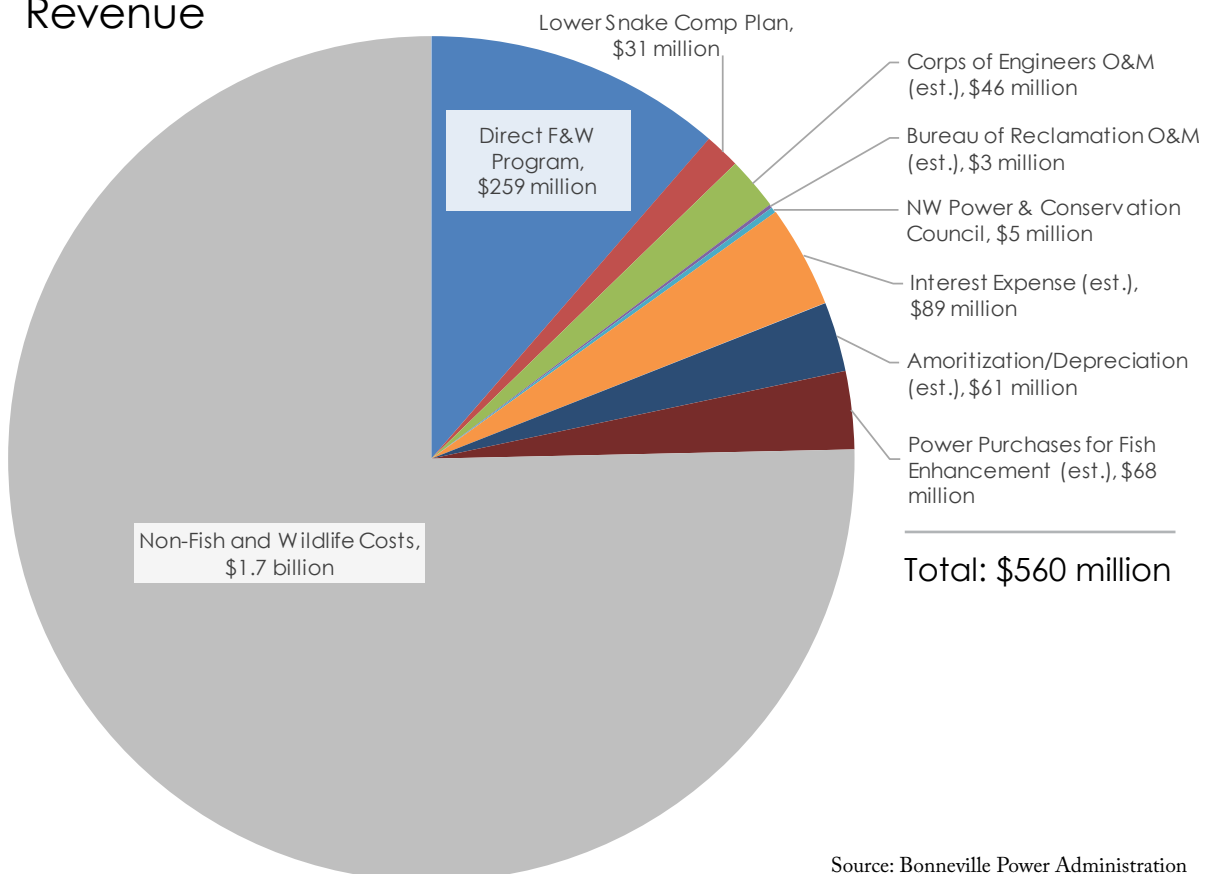
- \$258.2 million in direct (expense) costs.
- \$84.9 million in direct costs and reimbursements to the federal Treasury for expenditures by the Corps of Engineers, Bureau of Reclamation, and U.S. Fish and Wildlife Service for investments in fish passage and fish production, including direct funding of operations and maintenance expenses of federal fish hatcheries; this category also includes one-half of the Council's \$9.8 million in costs in Fiscal Year 2015 (the other half is assigned to the Power Business Line budget).
- \$150.6 million in fixed costs (interest, amortization, and depreciation) of capital investments for facilities such as hatcheries, fish-passage facilities at dams, and some land purchases for fish and wildlife habitat.
- \$195.8 million in forgone hydropower sales revenue that results from dam operations that benefit fish but reduce hydropower generation.
- \$67.5 million in power purchases during periods when dam operations to protect migrating fish reduce hydropower generation, such as by spilling water over dams in the spring or storing it behind

Fiscal Year 2015 Bonneville Fish and Wildlife Costs

(Total: \$757 million)



Fish & Wildlife Costs Comprise 1/4 of Total not Including Forgone Revenue



Source: Bonneville Power Administration

dams in winter months in anticipation of required spring spill.

The \$757 million total does not include the amount Bonneville borrowed from the U.S. Treasury in 2015 totaling \$21.4 million for program-related projects, and \$81.4 million for associated federal projects, which include capital investments at dams operated by the Corps of Engineers and Bureau of Reclamation. These investments are funded by congressional appropriations and repaid by Bonneville. Including them in the same total as fixed costs would double-count some of the capital investment. The total also does not reflect a credit of \$77.7 million from the federal Treasury related to fish and wildlife costs in 2015 that Bonneville is required to take under Section 4(h)(10)(C) of the Power Act. The annual credit comprises the obligations of other federal agencies for dam purposes other than hydropower, and which Bonneville pays in full. The credit is applied to Bonneville's federal Treasury debt. Subtracting the credit reduces the total fish and wildlife costs to \$679.3 million in fiscal year 2015 (the credit is explained in more detail in the "Power System Costs" section of this report).

The total of all fish and wildlife costs reported by Bonneville's Fish and Wildlife Division for Fiscal Year 2015 (\$757 million) includes forgone revenue and power purchases. How large is this relative to Bonneville's other costs? In the same year, Bonneville's entire Power Business Line costs totaled approximately \$2.277 billion. Including forgone revenue in the calculation means that fish and wildlife costs comprised 33.3 percent of Bonneville's total power-related costs. However, because forgone revenue is not a cost, but rather an estimate of lost revenue, Bonneville's Power Business Line does not include forgone revenue in its calculation of annual costs. Without forgone revenue, fish and wildlife costs comprise 24.5 percent of Bonneville's \$2.277 billion in total power-related costs.

Fish and wildlife costs account for a significant portion of the rate Bonneville charges its wholesale power customers. Approximately one-third of Bonneville's wholesale rate of \$31.50 per megawatt hour is estimated to be associated with its fish and wildlife program.

The Council understands the impact fish and wildlife costs have on rates and is working on measures to keep its

program as efficient and effective as possible. Accordingly, the Council formed a cost-savings workgroup that will identify and review on a regular basis fish and wildlife projects for potential close-out or significant cost reductions. The Council is continuing discussions regarding how it might find further cost savings and direct them to other projects associated with emerging priority areas identified in the program.

States anticipate federal money to help prevent the spread of invasive mussels

The battle to keep invasive freshwater mussels out of the Columbia River Basin was given a renewed sense of urgency in the fall of 2016 with the discovery of mussel larvae in several Montana water bodies in the Missouri River drainage east of the Continental Divide.

Lakes, rivers, and reservoirs in many parts of the United States are infested with zebra and quagga mussels. Mussels and their larvae, which can live out of water for up to 30 days, adhere to watercraft and thus can easily be transferred from an infested lake or river, where they form rock-hard mats of shells that can clog water intake structures such as those at dams and irrigation systems. It has been estimated that the combined economic impact of a Northwest-wide infestation (including British Columbia) could be nearly \$600 million per year in clean-up and prevention costs.

Until October and November of 2016, the regional war on mussels was a matter of concern but not emergency. But then larvae from quagga and zebra mussels were confirmed in water samples from several Missouri River tributaries east of the Continental Divide. Consequently, Montana Governor Steve Bullock issued an executive order giving state agencies and the Montana Invasive Species Advisory Council responsibility for containing and controlling the spread of invasive mussels, triggering the deployment of an interagency rapid response team to coordinate efforts to detect and respond to an infestation.

Watercraft inspection stations, funded and operated by the four Northwest states, and located along roadways leading into the region, have been effective at catching and cleaning infected watercraft, but more money is needed to boost



Chinook salmon (foreground), photo courtesy of Wikipedia

the effort. Although Congress provided \$4 million for the U.S. Army Corps of Engineers to assist the four Northwest states' efforts to establish and operate inspection stations, the funds have not been released to the states. The Council will continue its efforts to work with the states and other regional interests to enable the release of the money by the Corps.

Working to prevent an invasion of northern pike

Through the Council's fish and wildlife program, the Spokane Tribe of Indians is leading an effort to halt the spread of invasive northern pike in Lake Roosevelt, the reservoir behind Grand Coulee Dam. Pike, a voracious predator, have been found in the northern end of the lake near the Canadian border.

Popular with anglers but not with fishery managers, northern pike can grow to a meter in length and consume pounds and pounds of game fish like kokanee and westslope cutthroat trout. It isn't clear how northern pike

got into the lake. They may have been introduced illegally or they may have drifted downstream from infested waters upstream.

Regardless how pike got into the lake, they need to go before they take over, ruin fisheries established by the tribe and the state, and, perhaps pass over Grand Coulee and Chief Joseph dams. If they become established downriver, they could wreak havoc on salmon and steelhead.

The Spokane Tribe and other partners including the Washington Department of Fish and Wildlife, launched a public information campaign in 2016 to raise awareness and encourage anglers to keep or destroy the pike they catch rather than releasing them back into the lake. In addition to a public information campaign, the tribe and others are conducting research to gain a better understanding of where the fish are and how many are present – and whether the Lake Roosevelt population, so far confined to the northern end of the lake, is growing.

To assess the population, Lake Roosevelt fishery co-managers, including the Spokane and Colville tribes

and the department of fish and wildlife, set gill nets at random locations in the lake near Kettle Falls, where sport anglers have been catching pike, and then fish intensely in areas where the random netting shows pike congregate. Preliminary results confirmed different age classes of pike, suggesting the Lake Roosevelt population is growing.

Addressing toxic contaminants in the Columbia River

State and federal water quality agencies are working to identify and reduce toxic contamination in the Columbia River to protect both human and fish health. To assist in these efforts the 2014 Fish and Wildlife Program commits the Council to support these efforts through several means, such as initiating and participating in periodic science/policy workshops on characterizing the state of the science related to toxic contaminant issues, and assisting regional parties in advancing public education and information.

The program recommends that regional and state agencies should support the regional 2010 Columbia River Basin Toxics Reduction Action Plan prepared by the Environmental Protection Agency, which addresses water quality monitoring, research, and improvement measures needed to enhance the survival of anadromous and native resident fish and to meet Northwest Power Act, ESA, and Clean Water Act responsibilities.

Through the program, the Council also is participating in a regional work group to improve understanding of contaminants of emerging concern, such as endocrine-disrupting pharmaceuticals and chemicals in personal care products, and their effects on salmonids, sturgeon, and lamprey. The group is developing an interactive, web-based map to show the distribution and concentration of toxics in the basin, focusing initially on pesticides.

Court rejection of hydrosystem biological opinion does not affect the Council

In May 2016, the U.S. District Court for Oregon rejected the federal government's plan for protecting threatened

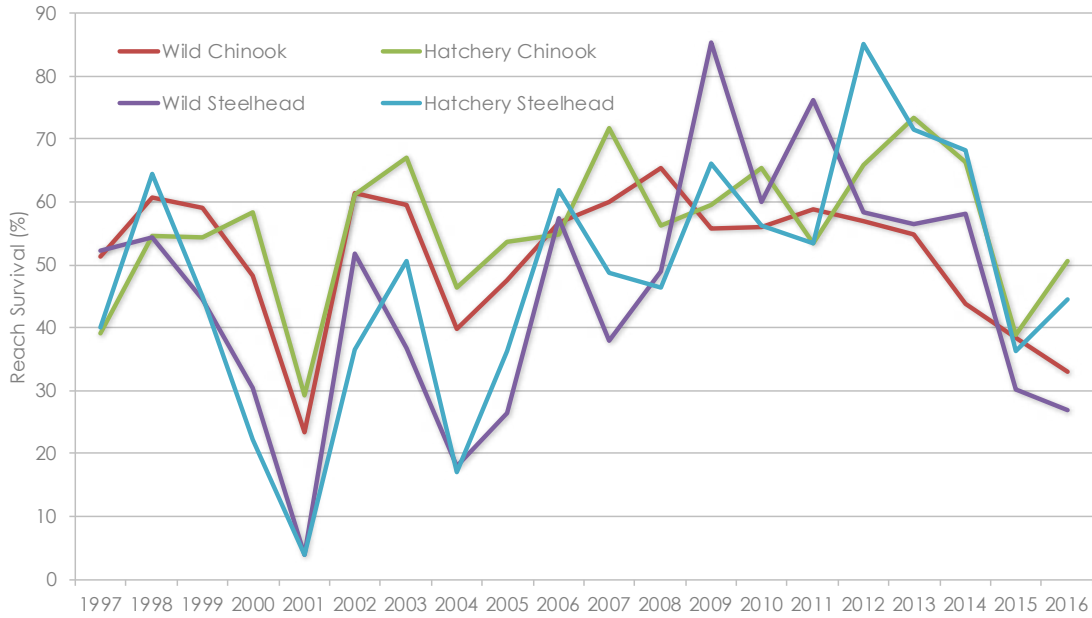
and endangered salmon and steelhead in the Columbia River Basin, the fifth time successive versions of the Federal Columbia River Power System Biological Opinion (BiOp) has been rejected.

Judge Michael Simon ruled that NOAA Fisheries violated the Endangered Species Act (and the federal Administrative Procedures Act) in determining that the Reasonable and Prudent Alternatives (RPAs) in the 2014 BiOp would not jeopardize the continued existence of the ESA-listed fish.

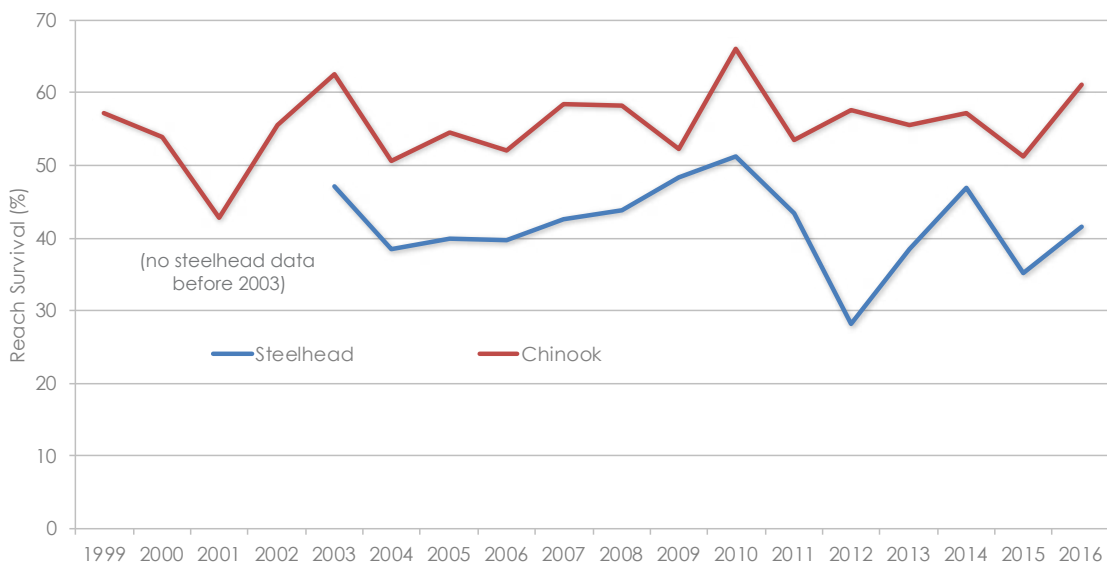
The Council was an amicus participant in the BiOp litigation, limited to issues that overlap and implicate the Northwest Power Act. While the Council does not implement the ESA, the water management and fish passage actions, flow objectives, and passage standards in the BiOp are the baseline flow and passage measures in the Council's fish and wildlife program. The program is broader than the Endangered Species Act both in terms of species affected by the hydrosystem and the ultimate objective of the program, which goes beyond just delisting endangered species. Consistent with the Northwest Power Act, the Council's program is designed to protect a broader range of species and their habitat, potentially utilizing different biological objectives than those in the BiOp.

The Council's 2014 Program is the subject of litigation in the U.S. Ninth Circuit Court of Appeals. Following Judge Simon's ruling, the Council filed a supplement to its answering brief in the Ninth Circuit litigation to make clear that while some measures in the program relate to listed species and thus were also reviewed in an ESA consultation, this does not affect the Council's assessment of these recommended measures for protection, mitigation and enhancement under the Northwest Power Act or their inclusion in the fish and wildlife program. The Council did not adopt the federal biological opinions, nor review, adopt nor endorse the ESA analysis, nor defer to ESA review consideration of the validity of the recommended measures. Thus, the federal court decision about the ESA should have no bearing on the Ninth Circuit's review of the Council's assessment of recommended measures for inclusion in the fish and wildlife program under the standards of the Northwest Power Act. However, the federal court decision about the biological opinion could affect how the Council addresses hydrosystem mitigation in future iterations of the program.

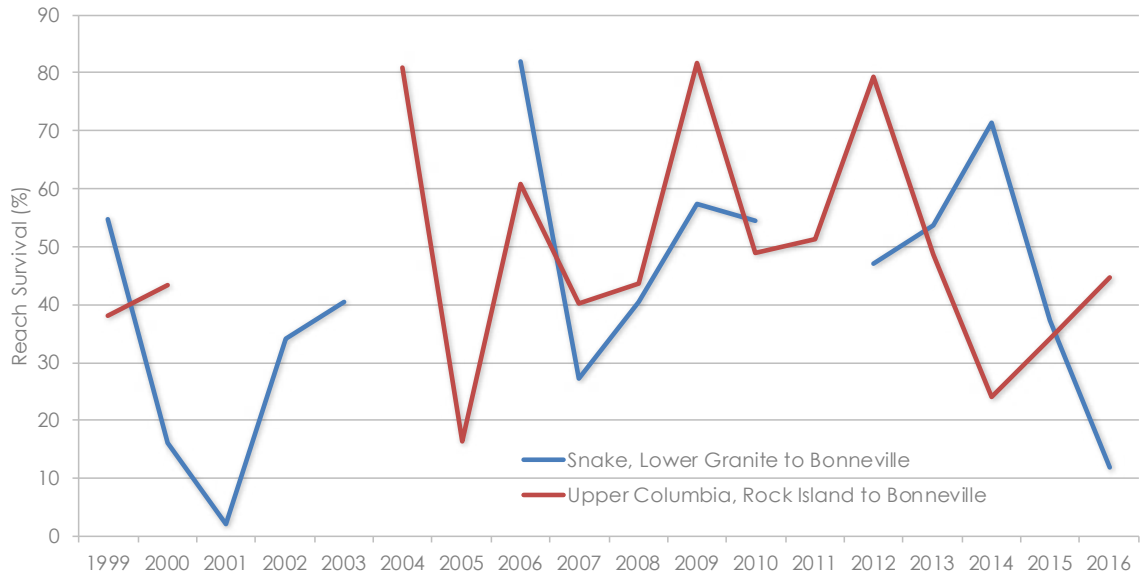
Reach Survival of Juvenile Snake River Chinook and Steelhead, Lower Granite to Bonneville Dams



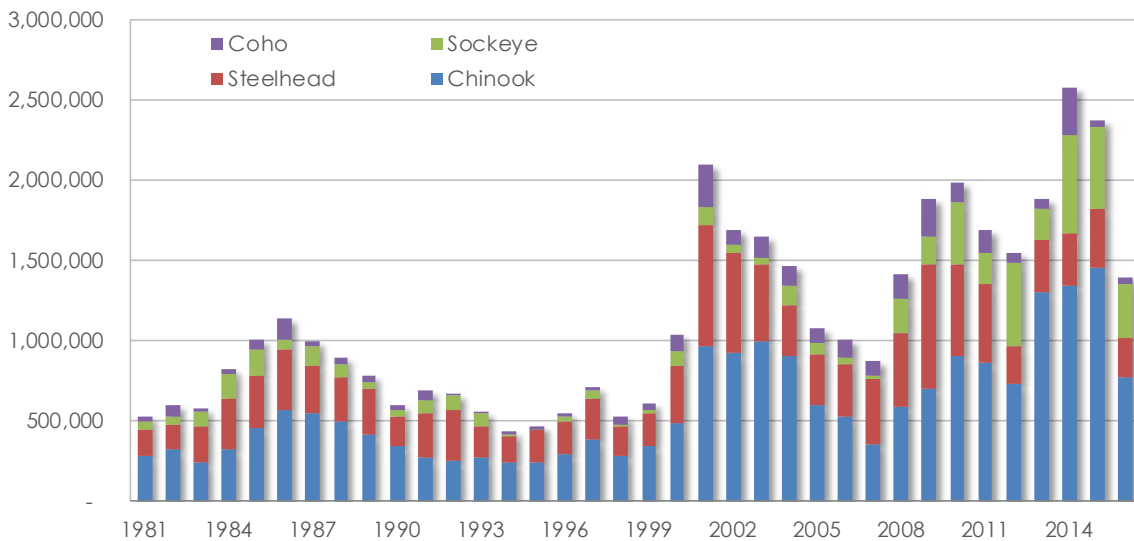
Survival of Juvenile Upper Columbia Hatchery Chinook and Steelhead, Release Site to McNary Dam



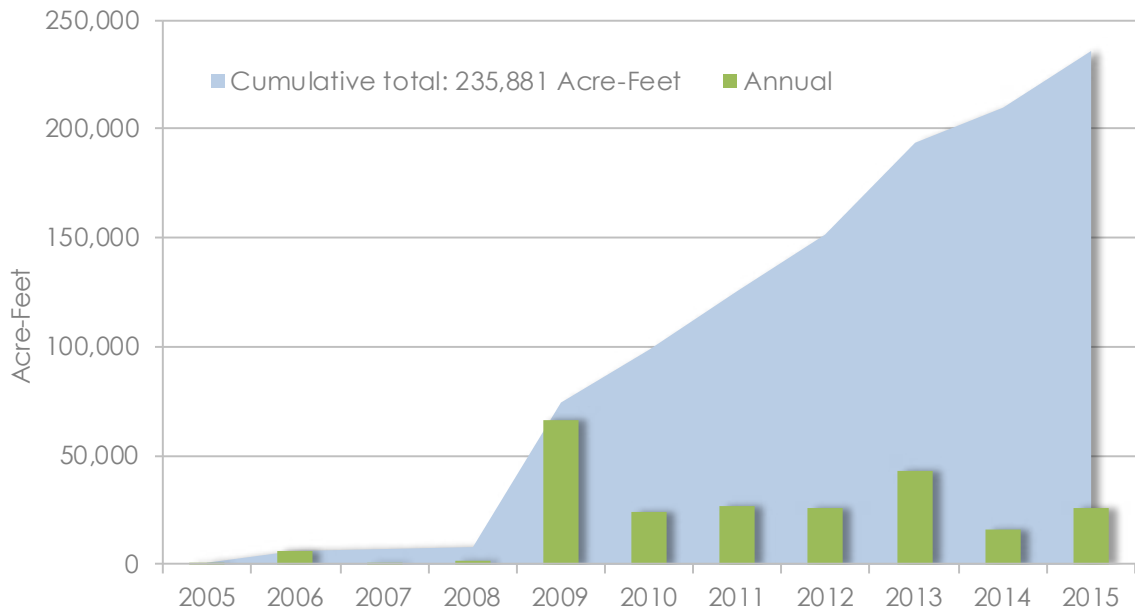
Survival of Juvenile Snake and Upper Columbia Sockeye, Lower Granite and Rock Island Dams to Bonneville Dam



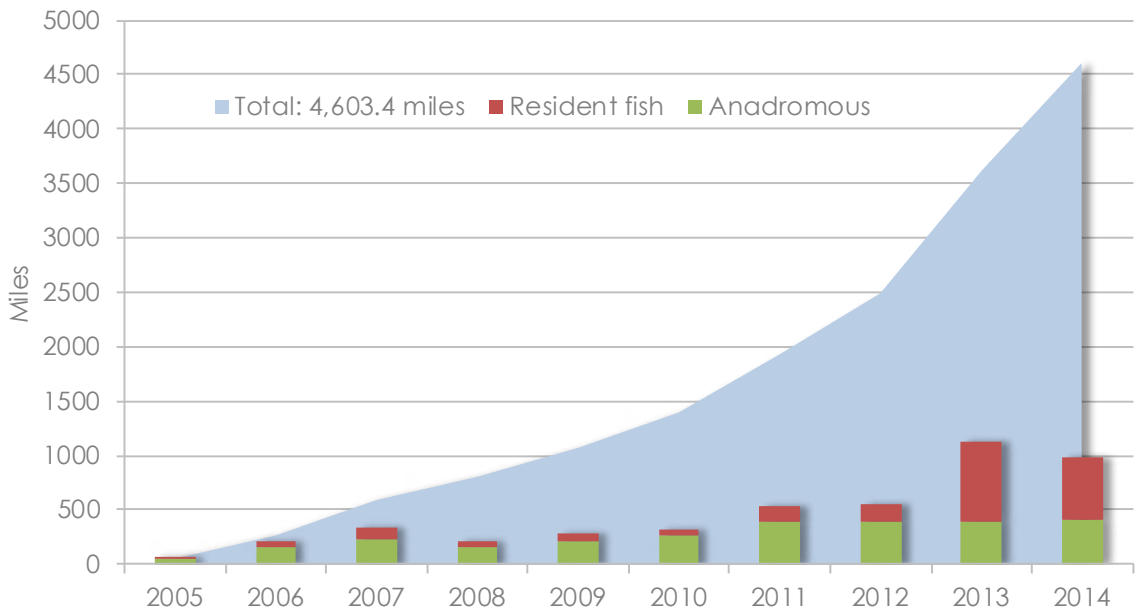
Salmon and Steelhead Counted at Bonneville Dam



Water Protected by Screening



Miles of Habitat Improved



Agencies prepare for another Columbia River hot-water emergency

Unprecedented high water temperatures in the Columbia River Basin in the summer of 2015, an emergency that caused the deaths of more than a quarter million sockeye salmon including the endangered Snake River species, spurred unprecedented cooperation in 2016 among the federal and state agencies, and tribes, that manage rivers, dams, and the fish whose survival is affected.

In essence the response was an effort to create an early-warning system in the event the summer of 2016 proved to be a repeat of conditions during the summer of 2015. Fortunately, while river temperatures did rise, they rose more slowly and not until after the bulk of the 2016 run had passed through the lower Columbia.

While the mid-summer temperature scare of 2015 did not repeat in 2016, the ocean environment remained unfavorable for cold-water species like salmon and steelhead. Scientists documented that the so-called “blob” of warm water in the north Pacific moved eastward into the near-shore area off the Northwest coast, reducing the food supply for species from salmon to whales.

In response, the agencies and tribes identified a number of potential responses including:

- Consider setting a water temperature trigger for emergency actions, and set it below the lethal limit of 68 degrees so that fish aren't on the edge of catastrophe before options are discussed. Such a system is in place in the Klamath River Basin in southern Oregon and Northwestern California, and it works well.
- Improve coordination and communication through existing committees that oversee river conditions and advise on fish-passage actions, such as the Fish Passage Advisory Committee
- Document the locations of cool-water refuges where migrating fish such as adult salmon and steelhead can reside temporarily when water temperatures are high
- Position mobile laboratories along river corridors to be able to respond quickly to assess dead fish and determine causes of death and the effects of temperature
- Close fisheries and reduce irrigation withdrawals in tributaries when conditions are lethal in order to protect fish and keep cool water in streams
- Longer term, overlay climate-change models with the location of fish kills to improve the ability to forecast where and how often low flows and high temperatures might affect fish, then develop place-specific mitigation plans
- Conduct additional temperature monitoring in rivers and in fish ladders

The group planned to meet through the summer of 2016 to discuss how to further improve communication and coordination among the many entities and data sources.

Sea lions feast on fish in the lower Columbia River

In the spring of 2016, NOAA Fisheries completed the seventh year of an ongoing study of sea lion predation on Columbia River spring Chinook salmon. Over the seven years of research, more than 2,200 spring Chinook were tagged in the estuary near Astoria, Oregon, and their migration progress monitored up the river to Bonneville Dam.

The results are discouraging. After accounting for harvest, annual survival has ranged from 55 to 90 percent, meaning that as many as 45 percent of the upriver fish (those that return to spawning grounds or hatcheries above Bonneville) tagged in the estuary did not arrive at Bonneville during some years. Coincidentally, since 2010, the population of sea lions and harbor seals in the estuary has exploded.

Sea lions and seals probably are the primary cause of the missing fish, but there are possible other causes, NOAA Fisheries reported to the Council. Those include fish turning into creeks in the lower Columbia to spawn, fish deaths from disease or injury, or even learned behavior – the same seals and sea lions returning year after year to the annual Columbia River salmon feast (most of the sea

lions arrive in the spring and leave by summer). But none of these is as strong a probable cause as predation by marine mammals, according to the NOAA researchers.

Meanwhile, after a particularly voracious spring, most of the sea lions that catch and kill salmon and steelhead at the base of Bonneville Dam, 146 miles inland from the ocean, moved on by the first week of June, 2016, having spent the better part of five months gorging on fish.

In its report on predation at the dam in 2016, the U.S. Army Corps of Engineers reported that sea lions killed nearly 9,000 salmon and steelhead at the dam this year, representing about 5.5 percent of the estimated total spring migration, a number that is about double the recent 10-year average catch. The Columbia River Inter-Tribal Fish Commission (CRITFC) hazed sea lions at the dam from

boats, and the states of Oregon and Washington removed 59 of the most aggressive California sea lions under a federal permit.



Sea lions at Astoria, Oregon, photo courtesy of Tony Grover

Effectiveness of actions taken under the fish and wildlife program

Section 4.(h)(12)(A) of the Northwest Power Act directs the Council to include in this annual report to Congress a description of the effectiveness of the fish and wildlife program.

For the last several years, as improvements in storing, accessing, and reporting data gathered through monitoring and evaluation of fish and wildlife projects has improved, the Council began tracking progress of fish and wildlife efforts in the Columbia River Basin using three high-level indicators. Posed as questions, they are:

1. Are Columbia River Basin fish species abundant, diverse, productive, spatially distributed, and sustainable?
2. Are operations of the mainstem Columbia and Snake River hydropower dams meeting the fish-passage survival objectives of the Program?
3. What is being accomplished by projects that implement the Council's Fish and Wildlife Program?

Over time, the Council expects to augment and refine the initial indicators to provide a more comprehensive picture of fish and wildlife in the basin. While this information stops short of providing evidence of the effectiveness of the Council's program or individual projects, the Council is separately pursuing additional approaches to shed light on the issue. The Council's high-level indicators are posted at www.nwcouncil.org/ext/hli. Information in the figures comes from NOAA Fisheries, the U.S. Army Corps of Engineers, and the Bonneville Power Administration and is reported at www.cbfish.org.



Council Public Affairs Overview

Outreach, information, and communication

The Northwest Power Act directs the Council to provide for the participation and consultation of the Pacific Northwest states, tribes, local governments, consumers, electricity customers, users of the Columbia River System, and the public at large in developing regional plans and programs related to energy efficiency, renewable energy resources, other energy resources, and protecting, mitigating, and enhancing fish and wildlife resources. The Council's Public Affairs Division has the primary responsibility to implement this portion of the Act.

The Division uses a variety of communication tools to perform its mission, including printed and electronic publications, the Council's website, social media platforms, video, public meetings, and press releases that are posted as news items on the website, and then linked to the news media and other interested parties via email and social media.

The Council's website, www.nwcouncil.org, functions as the hub of its outreach efforts and public information strategy. The website, which was revised and given a new look in 2013 and 2014, contains myriad documents,

publications, databases, and other forms of information. Included on the site are the current versions of the Northwest Power Plan and the 2014 Columbia River Basin Fish and Wildlife Program, as well as press releases, Council white papers, official public comment on Council products, PowerPoint presentations, videos, Council newsletters, and links to the Council's social media platforms.

Social media are used increasingly by the Council to communicate with the public. These include Facebook, Twitter, and LinkedIn, all of which are highlighted on the Council's News page. The Council also maintains Flickr and Instagram accounts to showcase and invite photos from around the Columbia River Basin.

The monthly Council Spotlight newsletter includes news about the monthly Council meetings and links to posts on the website.

The Public Affairs Division also has the responsibility of advancing the Council's mission and accomplishments with members of Congress and their staffs. In August 2016 the Council conducted its annual congressional staff trip, this time to Northeast Washington, including stops at Grand Coulee Dam, Lake Roosevelt, the Spokane Tribal Hatchery, and an energy-efficient building in Spokane.

The purpose of these annual trips is to better acquaint House and Senate staff with the requirements of the Northwest Power Act, the work of the Council, and a sampling of priority issues relating to the Council's work.

Canadian relations

The Columbia River and several of its major tributaries begin in Canada and flow across the international border. Consistent with direction in the Northwest Power Act to treat the entire Columbia River as one system for planning purposes, the Council maintains regular contact with planning entities in British Columbia. This contact primarily is through the Public Affairs and Legal divisions.

The Columbia Basin Trust (CBT), a Crown corporation of the province, is the Council's closest counterpart agency in the Canadian portion of the Columbia River Basin. Since 1996, Council members and staff have met at least once annually with the Trust Board of Directors to discuss Columbia River issues of mutual interest. In 2000, the two agencies formalized their relationship in a memorandum of understanding and designated official liaisons. The memorandum was revised in 2011.

In 2014 the Council and Trust co-sponsored a major international conference on the Columbia River that attracted more than 300 participants from the United States and Canada. In 2015, following up on commitments made at the conference, the Trust and Council participated in the Lake Roosevelt Forum conference in Spokane to raise awareness about issues including the reintroduction of salmon and steelhead above Chief Joseph and Grand Coulee dams, transboundary ecosystem management, and aquatic invasive species in the transboundary reaches of the Columbia River and its tributaries. At that conference the Trust and Council agreed to work on developing a follow-up conference on invasive species and to find a fish and wildlife project in the transboundary area to co-fund. We are working with Montana Fish, Wildlife & Parks and the BC Ministry of the Environment to identify a project for joint funding. For several years the Trust and Council have co-funded a project to improve understanding of burbot in Lake Koocanusa, the reservoir behind Libby Dam in Montana that backs up into British Columbia. Burbot in the lake migrate back and forth across the border.



Congressional staff preparing to tour Grand Coulee Dam, August 2016, photo courtesy of Tony Grover

Selected news articles that mention the Council

Power Shift: Data centers to replace aluminum industry as largest consumers in Washington

— [Puget Sound Business Journal](#), November 3, 2015

Climate change should prompt the Northwest to act on renewable energy

— [Seattle Times](#), December 22, 2015

Northwest Power draft plan sees little new generation coming for BPA

— [The Missoulan](#), November 8, 2015

With science as a guide, hatcheries have evolved to help rebuild runs

— [The Oregonian](#), March 23, 2016

Spokane Tribe will study salmon habitat above Grand Coulee Dam

— [The Spokesman-Review](#), April 18, 2016

(click any source above for full article)

Council Administrative Overview

Council funding background

The Northwest Power Act, as passed by Congress in 1980, establishes a funding mechanism to enable the Council to carry out its functions and responsibilities. The Bonneville Power Administration provides this funding through ratepayer revenues. The Act established a formula to determine a funding limitation threshold and authorized the Council to determine its organization and prescribe practices and procedures to carry out its functions and responsibilities under the Act.

The Act further provides that the funding limitation applicable to annual Council budgets will be calculated on a basis of 0.02 mill multiplied by the kilowatt hours of firm power forecast to be sold by the Bonneville administrator during the year to be funded. The limitation may be increased to .10 mill, provided the Council makes an annual showing that such limitation will not permit the Council to carry out its functions and responsibilities under the Act.

The basis of the funding methodology (firm power forecast to be sold) embraces authorities set forth in other sections of the Act that describe the Congressional expectation that Bonneville will serve all anticipated load growth for the region in the future. As such, the Act authorizes Bonneville to supply all of the incremental electricity needed in the future for the region, if so desired by its customers and others.

Fiscal Year 2018

The Council has determined that the 0.02-mill limitation will not allow the Council to carry out its functions and responsibilities under the Power Act in Fiscal Year 2018. The Council determined that an amount equal to .093 mill, which totals \$11,624,000, will be required in Fiscal Year 2018.

Annual baseline adjustments

Since 1997, the Council has negotiated annual budget ceilings with Bonneville that cover specific Bonneville rate periods. These negotiated agreements incorporate various budgetary constraints such as:

- Current-level service budgets from the preceding budget period
- Restrictive cost-of-living adjustments for personal services expenditures
- Cost-cutting actions to cushion the impact of inflation
- Program improvements individually cost-justified

By applying these budgeting principles on an annual basis, the Council has been able to successfully confine budget growth to an average of less than 3 percent per year over the last 20 years (1998-2018).



Budget versus actual expenditure considerations

The Council attempts to project workloads and resource requirements two years in advance with some opportunity for budget revisions occurring prior to the beginning of each fiscal year. During each annual budget cycle the Council:

- Manages overall expenditures to the most cost-effective level
- Conserves unanticipated cost savings in a prudent manner
- Re-prioritizes the allocation of funding and staff resources to accommodate new workloads and unanticipated responsibilities

Actual expenditures in one budget year may not necessarily be reliable indicators of funding requirements in future budget cycles because:

- Changes in Council workloads, programs, and responsibilities are difficult to anticipate and are often initiated by external events in the region or by requests from the Congressional delegation or the states' governors

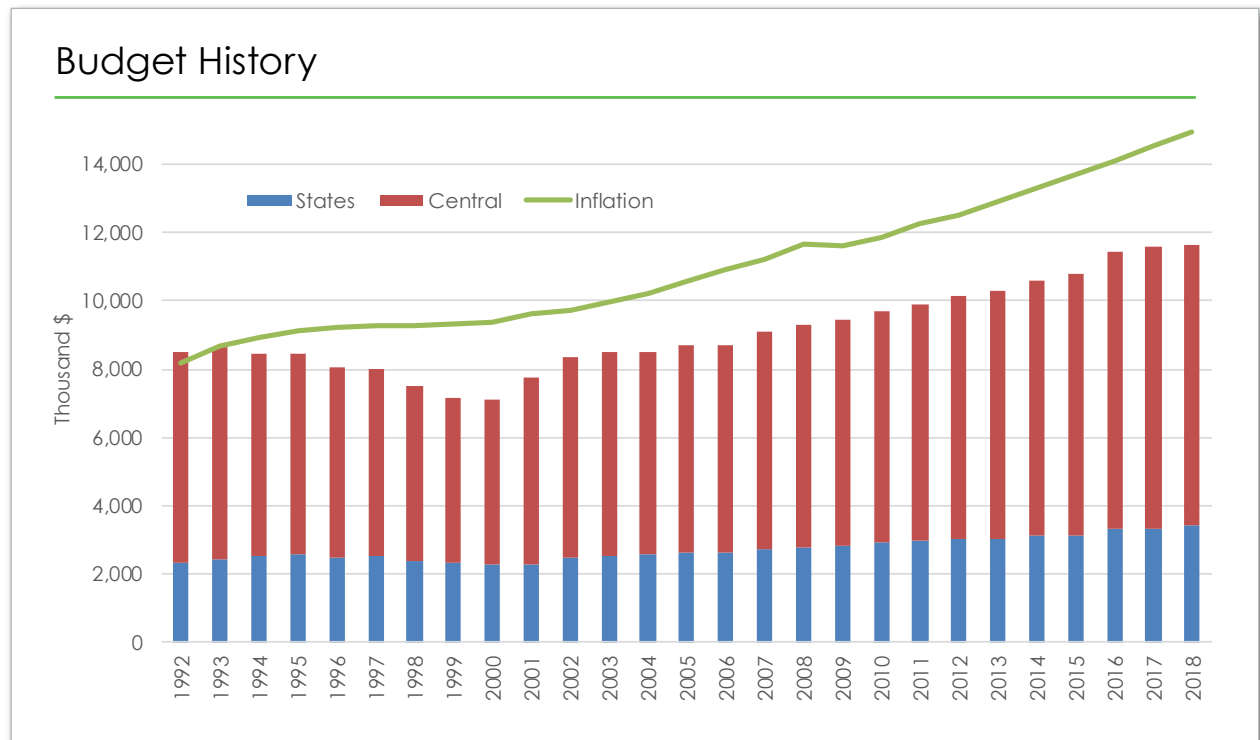
- Programs and activities that are budgeted, but deferred because of new and emerging higher priorities, are often re-budgeted in succeeding years because of their continued need and importance

Fiscal Years 2017-2018 draft budgets

The Council's budget reflects the proposed budget for Fiscal Year 2018 and the recommended revisions to the Fiscal Year 2017 budget. In addition, the draft budget contains the out-year budget projection for fiscal years 2019 and 2020. The Council is committed to carrying out its current responsibilities and workloads within these projected funding levels.

A summary of the draft budgets for the last seven budget years follows. These projections show budget growth of less than 14 percent over the six-year period, 2011 – 2017.

FY 2012	\$10,114,400
FY 2013	\$10,283,000
FY 2014	\$10,565,000
FY 2015	\$10,784,000
FY 2016	\$11,425,000
FY 2017	\$11,590,000
FY 2018	\$11,624,000



Fiscal Year 2017/2018 budget strategy

The Council is aware of the current economic challenges facing the four-state region, and the need to maintain healthy financial conditions for the Bonneville Power Administration. In an effort to be responsive, the Council in Fiscal Year 2017 and Fiscal Year 2018 will continue to adhere to the budget constraints initiated in 1998.

To accomplish this, the Council will:

- Continue to identify efficiencies in operations and administration in order to limit inflationary increases to below 3 percent, on average, during fiscal years 2009-2018
- Re-allocate staffing where possible to absorb new workload without increasing FTEs.
- Re-prioritize resources as necessary to respond to new requests for technical analysis
- Reschedule or postpone work anticipated during the budget-development process in order to respond to the most essential requests for studies and analyses

Fiscal Year 2018 proposed budget request

Based on the major issues and levels of effort anticipated in the fiscal year, the Council determined that the proposed budget expenditures are necessary and appropriate for the performance of its functions and responsibilities as authorized by the Northwest Power Act, Section 4(c)(10)(A). The Council further has determined that the 0.02 mill per kilowatt-hour limitation on expenses will not permit the Council to carry out its functions and responsibilities under the Act. The Council proposed in Fiscal Year 2016 that the projected budget in the amount of \$11,624,000 for Fiscal Year 2018, equal to 0.093 mills per kilowatt-hour for the estimate of forecast firm power sales, be included in the Bonneville administrator's Fiscal Year 2018 budget submittal.

Fiscal Year 2017 proposed budget revisions

The Council's Fiscal Year 2017 revised budget of \$11,595,000 includes a \$28,000 decrease from the

previously submitted Fiscal Year 2017 budget request of \$11,623,000. This decrease was due predominately to increased contracting in the Public Affairs Division for continued website redevelopment and support, and increased contracting in the Power Division. These increases are more than offset by reduced staffing levels in the public affairs and fish and wildlife divisions, and reductions in the state office budgets. The Council's budget for Fiscal Year 2018 and Revised Fiscal Year 2017 is based on current-year expenditure levels plus adjustments for shifting workloads, certain program improvements, and cost-of-living adjustment factors as provided by the U.S. Department of Energy (Bonneville) and the Oregon Economic and Revenue Forecast. A number of cost-containment measures for personal services, travel, contracts, and services and supplies have been incorporated in the budget.

More information

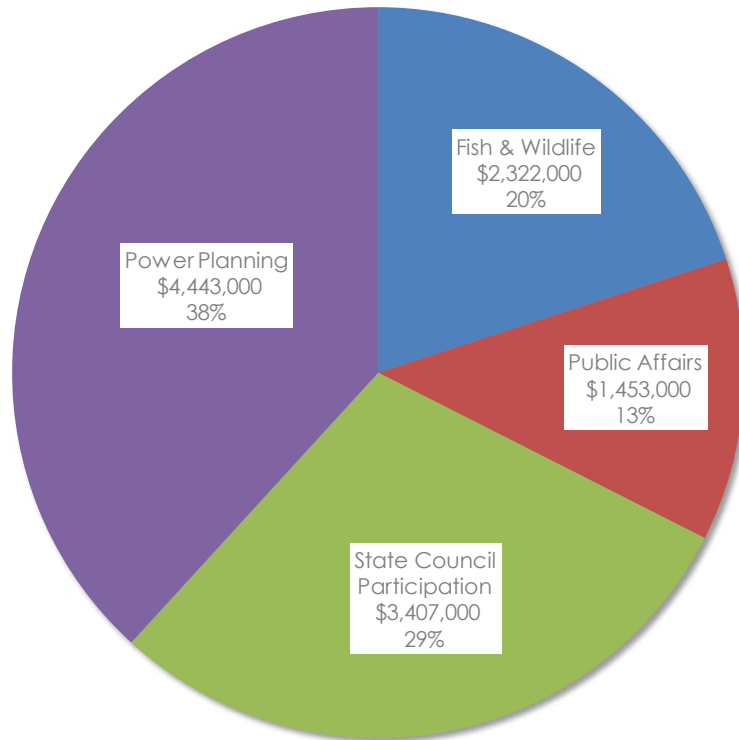
For additional information about the Northwest Power and Conservation Council's activities, budget, meetings, comment deadlines, policies, or bylaws, call 1-800-452-5161 or visit www.nwccouncil.org. Copies of Council publications are available at the website or by calling the Council. All Council publications are free.



FY 2017 Revised Budget Forecast (000s omitted)

	Power Planning	Fish & Wildlife	Public Affairs	Legal	Admin	Total
Compensation	1,510	867	470	285	881	4,013
Other Payroll Expenses	710	407	221	134	414	1,886
Travel	96	65	60	24	29	274
Contracts	465	140	150	8	40	803
Other Operating Expenses	204	8	130	23	937	1,302
SUBTOTAL	2,985	1,487	1,031	474	2,301	8,278
State Budgets:						
Idaho	815					
Montana	858					
Oregon	778					
Washington	866					
SUBTOTAL	3,317					3,317
TOTAL						11,595

Budget by Function for FY 2018: \$11,625,000



Council meetings, with links to agendas and notes, Fiscal Year 2016

- [October](#) 2015 Vancouver, Washington
- [November](#) 2015 Portland, Oregon
- [December](#) 2015 Portland, Oregon
- [January](#) 2016 Portland, Oregon
- [February](#) 2016 Portland, Oregon
- [March](#) 2016 Portland, Oregon
- [April](#) 2016 Missoula, Montana
- [May](#) 2016 Boise, Idaho
- [June](#) 2016 Redmond, Oregon
- [July](#) 2016 Olympia, Washington
- [August](#) 2016 Polson, Montana
- [September](#) 2016 Spokane, Washington



Comments of the Bonneville Power Administration



Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

EXECUTIVE OFFICE

February 3, 2017

In reply refer to: DIR-7

Mr. Henry Lorenzen, Chair
NW Power and Conservation Council
851 SW Sixth Avenue, Suite 1100
Portland, OR 97204

Dear Chair Lorenzen:

I want to thank the NW Power and Conservation Council for its important work in the Pacific Northwest. The Council continues to plan for a clean and reliable energy future for the region while it appropriately considers and identifies strategies to harmonize the impact of the federal hydro system and the environment.

In 2016, the Council issued the Seventh Northwest Conservation and Electric Power Plan, continuing its legacy of prioritizing energy efficiency as the resource of choice for the region. The Seventh Plan also encourages the Bonneville Power Administration (BPA) and regional utilities to develop demand response programs and explore other emerging technologies to address concerns about future capacity needs. In addition, the Council did excellent work in helping the region understand different options for lowering carbon emissions and the related costs. I appreciate the ongoing coordination between the Council and BPA staff to implement provisions of the Plan, including efforts to enhance BPA's load forecasting model, develop strategies for increasing energy efficiency participation in hard to reach markets, and other elements related to power planning.

Related to fish and wildlife, 2016 saw the Council and BPA continue to implement important provisions of the 2014 Columbia River Basin Fish and Wildlife Program (Program). Of particular note were the efforts of the Cost Savings Work Group, a partnership between BPA and the Council to identify existing projects that can be closed out and thereby free up financial support for emerging priorities. In addition, BPA appreciated the Council's efforts to improve regional understanding of operations and maintenance needs at facilities and projects across the region. The Council's effort to update the Research Plan was also commendable. Going forward, the biggest priority for BPA will continue to be focusing on cost-efficient means to effectively protect, mitigate, and enhance fish and wildlife in a manner consistent with the Program and assure full compliance with other related statutory responsibilities, such as those under the Endangered Species Act.

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Another priority for BPA in 2017 is continuing to identify the steps needed to ensure that we remain cost competitive in the future. We started this process in 2015 with several engagements through 2016. I appreciate the Council's willingness to participate with BPA and other regional interests to explore different scenarios and help inform our decision-making process related to ensuring BPA's long term financial health.

I am looking forward to a productive, informative and collaborative 2017.

Sincerely,

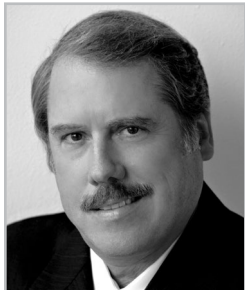


Elliot E. Mainzer
Administrator and Chief Executive Officer



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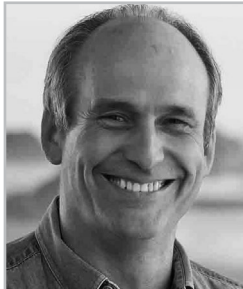


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COLUMBIA RIVER, PHOTO COURTESY OF TONY GROVER

COVER PHOTO COURTESY OF DEBBIE ASAKAWA



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