Northwest Power and Conservation Council

December 3, 2008

MEMORANDUM

TO: Council Members

FROM: John Fazio, Senior System Analyst
James Ruff, Manager, Mainstem Passage and River Operations

SUBJECT: Adequacy, Efficiency, Economy and Reliability of the Power Supply

As part of its 2009 Fish and Wildlife Program, the Council must determine whether implementing the Program will affect the adequacy, efficiency, economy or reliability of the power supply. The Council must also determine if the Program is consistent with other purposes of the Northwest Power Act, which include encouraging conservation and timely repayment of Bonneville's debt to the Treasury.

To make this assessment, a comparison is made between a regional power operation that implements Program measures and one that does not.[1] Council analysis indicates that, on average, implementation of the Program will reduce hydroelectric generation by about 1,170 average megawatts, which amounts to about 10 percent of its firm generating capability. This energy loss translates into an average regional cost of $434 million per year. In addition, fish and wildlife related capital costs and other Program expenditures are expected to average $56 million and $231 million, respectively over the next five years. Total regional cost of the Program averages about $720 million per year, which represents about 20 percent of Bonneville's annual net revenue requirement.

While in total, the Program's impact is substantial, most of its measures have already been implemented (somewhat incrementally) since the early 1980s, thus giving the power system and Bonneville time to integrate and adjust to them. Because of this, the Council concludes that the Program will not affect the adequacy, efficiency, economy or reliability of the power supply in a way that cannot be accommodated for in a timely manner. The Council's current assessment indicates that implementing the Program and only taking existing resources into account, the regional power supply is adequate through the next five years, although summer peaking capacity has been substantially reduced due to fish and wildlife operating constraints.

[1] This analysis compares a power operation that implements all the Fish and Wildlife Program operations to an operation that has no fish and wildlife operations included. This is a significantly different analysis than the one we conducted in July 2008, when we compared the 2008 FCRPS BiOp operation to the 2004 BiOp operation.

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DRAFT - December 3, 2008

Appendix xx
to the Northwest Power and Conservation Council's 2009
Columbia River Basin Fish and Wildlife Program

Analysis of Adequacy, Efficiency, Economy and Reliability of the Pacific Northwest Power System

Executive Summary

The Northwest Power and Conservation Council's Columbia River Basin Fish and Wildlife Program (Program) must consist of measures to "protect, mitigate, and enhance fish and wildlife affected by the development, operation, and management of [hydropower] facilities while assuring the Pacific Northwest an adequate, efficient, economical, and reliable power supply."[1] "Assuring" the region of such a power supply implies a reasonable degree of certainty that the objectives of adequacy, efficiency, economy and reliability will be achieved.

The Council must also determine whether the Program is consistent with the purposes of the Northwest Power Act.[2] These purposes include encouraging conservation of electricity and timely repayment of the Bonneville Power Administration's (Bonneville) debt to the federal Treasury.[3] An adequate, efficient, economical and reliable power supply, including a healthy and financially viable Bonneville, is essential to carrying out those purposes.

This appendix documents the Council's conclusions regarding the effect of the Program on the regional power supply and on the financial stability of Bonneville. To make this assessment, a comparison is made between a power operation that implements the Program measures and one that does not. While in total, the Program's impact is substantial; both in terms of energy loss and cost (see below), most of its measures have already been implemented (somewhat incrementally) since the early 1980s, thus giving the power system and Bonneville time to adjust. Because of this, the Council concludes that the Program will not affect the adequacy, efficiency, economy or reliability of the power supply in a way that cannot be accommodated for in a timely manner.

The hydroelectric operations specified in the 2008 Program, which are virtually identical to those in the NOAA Fisheries' 2008 Federal Columbia River Power System (FCRPS) Biological Opinion (BiOp), have a sizeable impact on power generation. Council analysis indicates that, on average, implementation of the Program will reduce hydroelectric generation by about 1,170 average megawatts, relative to an operation without any constraints for fish and wildlife.[4] For perspective, this energy loss represents about 10 percent of the hydroelectric system's firm generating capability[5].

The loss of hydroelectric generating capability translates into an average cost of $434 million per year to the region. In addition, fish and wildlife related capital expenses over the next

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[1] 16 U.S.C. § 839b(h)(5).

[2] 16 U.S.C. § 839 b(h)(7)

[3] 16 U.S.C. § 839(1), (4).

[4] The comparison study, which includes no actions for fish and wildlife, is represented by hydroelectric operations prior to 1980.

[5] Firm hydroelectric generating capability is about 11,900 average megawatts (2007 Bonneville White Book) and is based on the critical hydro year, which is currently defined to be the 1937 historical water year.

five years are expected to average $56 million[6]. Moreover, additional expenditures amounting to $231[7] million per year are needed to implement other Program measures, including the actions in the 2008 BiOp and 2008 Columbia Basin Fish Accord actions million per year. The total regional cost of the Program is expected to average about $720 million per year over the next five years, which represents about 20 percent of Bonneville's annual net revenue requirement.[8]

The power system impacts of the Program are clearly substantial and would definitely affect the adequacy, efficiency, economy and reliability of the power system, if they were implemented over a short term. However, this has not been the case. Since 1980, the region has periodically amended fish and wildlife related hydroelectric operations. In each case, the power system has had time to adapt to these incremental changes and has maintained, to the extent possible, an adequacy, efficient, economical and reliable power supply. This is not a surprising result, as the Northwest Power Act expects the power planning work of the Council and the associated power supply efforts of Bonneville to be able to accommodate the effects of the Program.

The Council's current assessment[9] indicates that the regional power supply is adequate, although summer surplus peaking capacity has been substantially reduced due to fish and wildlife constraints. Also, recently adopted state renewable resource portfolio standards[10], potential carbon dioxide limits and/or taxes and the changing shape of electricity demand have all contributed to making the assessment of adequacy and reliability much more difficult. However, the resource strategy that will be developed in the sixth power plan will take these and other issues into consideration to assure that the region continues to have an adequate, efficient, economical and reliable power supply.

Background

There is a wide spectrum of views in the region regarding the meaning of an adequate, efficient, economical and reliable power supply. Some hold that it must be considered entirely in the context of the power system that existed in 1980 (pre-Northwest Power Act and associated fish and wildlife operational constraints). In this view, an acceptable power supply is one whose characteristics only differ in a minor way from those of the 1980 system. For others, it may mean doing whatever is necessary to accommodate the needs of fish and wildlife, so long as some kind of power system can be maintained that is roughly as adequate, efficient, economical and reliable as those in other parts of the nation.

It would be difficult to argue that the power system impacts of the Program have made the power system inadequate, inefficient, uneconomical and unreliable in an absolute sense. The system has been operated for a number of years under similar fish and wildlife constraints without disastrous consequences for the system or the regional economy. However, the cost to the power system has been considerable nonetheless. Consequently, the Council is interested in the power system impacts of all fish and wildlife-related actions.

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[6] Taken from Bonneville's 2008 Integrated Program Review, the capital budget estimate for the next five years represents the maximum cost; actual expenditures may be less.

[7] The direct Program, 2008 BiOp and Fish Accord budget estimates for the next five years represent budget ceilings; actual expenditures may be less.

[8] Bonneville's annual net revenue requirement is on the order of $3.5 billion (Bonneville's 2007 Annual Report).

[9] See http://www.nwcouncil.org/energy/resource/Adequacy%20Assessment%20Final.doc.

[10] As of the date of this publication, Oregon, Washington and Montana have adopted renewable resource portfolio standards.

The question of how the impacts of fish operations on the power system can be lessened, while still fulfilling the Act's objective of protecting, mitigating and enhancing the fish and wildlife of the Columbia Basin, is at the forefront of the Council's thinking. In fact, the Council's Program calls for a re-evaluation of specific mainstem fish passage actions, e.g., determining the optimal fish passage strategy at each mainstem dam, including an evaluation of various passage methods and surface bypass technologies that may produce the same or greater benefit to fish while also spilling less water.[11] The Council has already done some work to evaluate the cost of spill at specific projects.[12] This information, considered in light of the uncertainty regarding the effectiveness of flow augmentation and spill, should help frame some of the mainstem components of a research agenda that could improve the cost-effectiveness of actions designed to protect fish and wildlife.[13]

For example, bypass spill requirements and reduced mainstem reservoir operational limits imposed by the Program limits the flexibility of the hydroelectric system. This is important because less flexibility means a reduced ability to integrate wind and other variable generation. Once system flexibility is used up, additional resources may need to be added along with wind generators in order to provide a reliable supply. This will clearly increase the cost of meeting renewable portfolio standards and will also likely increase carbon emissions. At some point, the tangible and quantifiable negative effects of reduced hydroelectric flexibility need to be compared to the arguably uncertain benefits of some spill and flow activities.

The experience of 2000-2001 revealed serious problems with the planning, development and operation of the power system with respect to maintaining an adequate, efficient, economic and reliable power system. During that period, the system was unable to meet loads, satisfy the spill requirements of the BiOp and maintain moderate energy prices in what turned out to be a very poor water year. However, while the effects of fish operations on the power system contributed in some measure to the problem, they were by no means the cause.

The problem in 2000-2001 was the consequence of a systemic failure to develop sufficient resources, exacerbated by characteristics of an immature and, particularly in the case of California, deregulated and poorly designed power market. One of the mechanisms by which the regional power system coped with the crisis was to dramatically curtail bypass spill at mainstem dams for listed salmon and steelhead. This spill curtailment was done to be able to increase summer energy production, reduce purchased power costs, and to store energy (water) for winter use. Some have argued that reliability of the power system was protected at the expense of fish and wildlife in 2001.[14] Yet, in spite of these actions, very large costs were still incurred by the regional power system in meeting the flow requirements of the BiOp in 2001.

In light of the 2000-2001 events, the Council recognized the importance of defining an adequacy standard for the Northwest's power supply and so added an action item in its fifth power plan to create the Northwest Resource Adequacy Forum. The Forum was tasked with developing a meaningful measure of adequacy for the power supply. In April of 2008, the Council adopted the Forum's recommended standard[15]. Each year the Forum assesses the

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[11] Mainstem Amendments to the Columbia River Basin Program, [need current URL].

[12] Cost and Energy Impacts of Fish and Wildlife Operations, http://www.nwcouncil.org/library/2002/costenergyimpacts/slide1.HTM

[13] "Mainstem Passage Strategies in the Columbia River System: Transportation, Spill, and Flow Augmentation" by A. Giorgi, M. Miller, and J. Stevenson of BioAnalysts, Inc. (Giorgi et al. 2002).

[14] In reality, changes in fish operations were only one aspect of the response to tight supplies and high prices. Other responses included very large long-term curtailments of electricity loads and substantial new "emergency" generation.

[15] See http://www.nwcouncil.org/energy/resource/Adequacy%20Assessment%20Final.doc.

adequacy of the power supply to ensure that, at a minimum, the region would not experience a significant service curtailment due to a lack of supply.

While there have been significant changes in the market since 2001, it is unclear that all the root causes have been adequately addressed. The revision of the power plan that is underway is analyzing these problems and possible solutions. Among the specific issues is the interaction of the fish operations and the power system during periods of power system stress and how to assure equitable treatment of fish in that context.

This does not mean that, in adopting the fish and wildlife measures, the Council need not make a determination that the fish and wildlife program does not jeopardize the ability of the region to have an "adequate, efficient, economical and reliable power supply." It must do so. But its determination must also recognize that a fuller analysis of the issue will follow in the revision of the power plan.

In summary, the adequacy, reliability, efficiency and economy of the region's power supply can only be fully evaluated in the context of a full revision of the Council's Power Plan, which is currently underway. Congress appears to have had this in mind. Congress anticipated that the Council would develop the fish and wildlife program immediately after passage of the Act.[16] In contrast, the Council was given up to two years to develop the power plan, subsequent to the adoption of a new Program. Among its several purposes, the Council's Power Plan is intended to lay out a resource strategy that will:

> reduce or meet the Administrator's [of the Bonneville Power Administration] obligations with due consideration by the Council for (A) environmental quality, (B) compatibility with the existing regional power system, (C) protection, mitigation and enhancement of fish and wildlife and related spawning grounds and habitat, including sufficient quantities and qualities of flows for successful migration, survival, and propagation of anadromous fish, and (D) other criteria which may be set forth in the plan.[17]

In a sense, the Act establishes a reciprocal arrangement between the Council's fish and wildlife program and the power plan. The Program must still assure the region that it will not cause the power system to be inadequate, inefficient, uneconomical and unreliable. In return, the requirements of the Program are factors to be taken into account in the development of the power plan. In other words, the mutual impacts of fish and power measures are intended to be examined together.[18] The potential impacts of a particular fish and wildlife measure may look different in the context of a full revision of the power plan than they do during the fish and wildlife amendment process. That is, it is likely that we will be better able to assure an adequate, efficient, economical and reliable power supply that also adequately supports the protection, mitigation and enhancement of fish and wildlife in the context of a full revision of the power plan.

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[16] Remarks of Rep. Dingell, Cong. Rec. p. H10683, November 17, 1980.

[17] 16 U.S.C. § 839b(e)(2).

[18] 16 U.S.C. § 839b(e)(3)(F).

Definition of Adequate, Efficient, Economical and Reliable

Adequate and Reliable

Adequate and *reliable* have specific meanings in the power industry. Adequacy is a component of reliability. A Power system is ***reliable*** if it is:

–***Adequate*** - the electric system can supply the aggregate electrical demand and energy requirements of the customers at all times, taking into account scheduled and reasonably expected unscheduled outages of system elements.

–***Secure*** - the electric system can withstand sudden disturbances, such as electric short circuits or unanticipated loss of system elements.[19]

Adequacy refers to having sufficient resources – generation, efficiency and transmission – to serve loads. In determining adequacy, the Council uses sophisticated computer programs that simulate the operation of the power system over many different futures. Each future is simulated under a different set of unknown parameters, such as water supply, temperature, wind generation and thermal resource performance. The current Northwest standard calls for the power supply to have sufficient resources (both generating and conservation) to limit the likelihood of future years with significant curtailments to no more than 5 percent. The power supply must have sufficient capability to protect against both cold snaps in winter and heat waves in summer.

Security is achieved largely by having reserves that can be brought on line quickly in the event of a system disruption and through controls on the transmission system. These reserves can be in the form of generation or demand side curtailment that can take load off the system quickly. The North American Electric Reliability Corporation (NERC) and the Western Electricity Coordinating Council (WECC) establish reserve requirements. The reserve requirement is frequently expressed in terms of a percentage of load or largest single contingency, e.g., the loss of Energy Northwest's Columbia Generating Station. The reserves required for security are an additional resource requirement necessary for a reliable power system.

Efficient

The objective of planners and operators of the power system is to provide a system that is as efficient as possible given that the largest component, namely the hydroelectric dams, have equally important non-power uses, including operations for fish and wildlife. From the single objective of power operations, the power system is less efficient than it was at the time of the passage of the Act. This is the result of many factors, some of which are just related to characteristics of new resources available to meet growth and some related to the effects of fish recovery measures. It is still, however, a very efficient system relative to systems elsewhere. The Council does not believe that the framers of the Power Act meant the term "efficient" to establish an absolute standard. The system is currently operated efficiently given all the constraints under which it must operate. The consequences of not doing so are economic -- additional costs to supply a given amount of power. Regulation and least-cost planning requirements encouraged the development of efficient resources. Since 1980, thanks in large part to Council efforts, the region has conserved nearly 3,500 megawatts of electricity.

[19] "Glossary of Terms," North American Electric Reliability Corporation, Glossary of Terms Task Force, August 1996 and also see http://www.nerc.com/page.php?cid=1%7C15%7C122.

The Northwest Power Act clearly expected a balancing of fish and power objectives, i.e., operating the system with multiple objectives. Fish objectives should also be met as efficiently or cost-effectively as possible. Given the high cost of some fish measures and the uncertainty regarding their effectiveness in meeting biological objectives, it is imperative that efforts be made to assess and improve the cost-effectiveness of these measures. The Council has addressed this issue in its amended Fish and Wildlife program by calling for evaluations to better quantify the benefits of operations so choices can be made to assure the same survival benefits are achieved through the lowest-cost operation.[20]

Economical

Many of the concerns with respect to adequacy, reliability and efficiency boil down to the question of economics. We can certainly assure ourselves of an adequate and reliable power system if we are willing to spend the money. But will the system still be economical? We can degrade the efficiency of the system, but that will affect its economics.

There are several ways of thinking about the economical criterion. One is whether the per-kilowatt-hour costs of the system have been caused to increase significantly in comparison to other regions. On this basis, the power system is clearly less economical than it was. However, in terms of absolute electricity cost, the Northwest still ranks as one of the lowest cost regions in the nation.

Unfortunately, this kind of aggregate look at the question does not capture the potential impacts on specific sectors of the economy. In particular, electricity-intensive industries, such as aluminum smelting, are proportionately harder hit by increases in electricity costs. In fact, most aluminum plants in the region have ceased operation due to high operating costs. Fish recovery costs have contributed to this, although in the current context, they are not the major contributor.

Secondly, economical relates to the question of whether the fish and wildlife program is consistent with other purposes of the Act, in particular, timely repayment of Bonneville's debt to the United States Treasury. Bonneville, although concerned about its fiscal status, is not currently in difficult financial circumstances and the implementation of the Program does not change that. However, fish and wildlife costs are a significant contributor to Bonneville's overall cost structure and must be reviewed periodically.

Finally, the longer-term question of assuring an economical power supply in the future is being addressed in the sixth power plan. The fundamental issues are the same as those related to the adequacy and reliability of the system: Are there adequate incentives for the development of new resources; can retail loads be made more responsive to prices; and is the region developing a resource portfolio that adequately hedges risks while still achieving low cost and conforming to existing and potentially new environmental constraints?

[20] Mainstem Strategies-Overarching Strategies section of the Program.

Program's Impact to Cost and Adequacy

Cost

Council analysis has found that the current Columbia River Basin Fish and Wildlife Program, relative to a "pre-1980"[21] operation, reduces average regional energy generation by approximately 1,170 average megawatts[22] and has an average annual cost of approximately $434 million, when evaluated using wholesale electricity market prices in an efficiently functioning market.[23] For perspective, the regional firm hydroelectric generating capability is about 11,900 average megawatts.

Bonneville not only absorbs most of the $434 million per year power system cost but also must provide about $56 million per year for capital improvements and about $231 million per year to implement direct Program measures, 2008 BiOp actions and 2008 Fish Accord actions. The total cost of about $720 million/year, amounts to roughly 20 percent of Bonneville's annual net revenue requirement. However, as the experience of 2000-2001[24] demonstrated, power system impacts can be much greater when conditions deviate significantly from those averages. Council analysis indicates that while the average power system cost of the Program is about $434 million per year, it can range as high as $1 billion under low water conditions and high electricity prices.

In 2001, Bonneville estimated that its additional power purchases and foregone revenues attributable to the flow and bypass spill requirements of the BiOp were $1.5 billion.[25] Had bypass spill not largely been curtailed, the cost would have been considerably larger. The large increase in cost was attributable to the fact that market prices across the period were approximately a factor of 10 greater than those seen under "normal" market conditions.

Since 2001 the landscape for the Northwest regional power system has changed dramatically. Regional demand remains about 10 percent lower than pre-2001 levels while generating capability has increased by about 22 percent[26]. This swing in the balance between resources and demand provides an environment that is more stable with respect to price fluctuations. Given recent state renewable resource portfolio standard legislation (in Oregon, Washington and Montana) and other resource acquisitions by Northwest utilities, the likelihood of a repetition of the price spikes of 2001 is very low. However, the region's planners now face a new challenge, in how to best integrate these variable resources while maintaining a reliable supply. The loss of hydroelectric flexibility (its ability to shape generation to ever changing loads), due to Program constraints will make it more difficult and more expensive to integrate wind into the system.

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[21] The operation of the system has always taken into account multiple purposes such as flood control, recreation, navigation and irrigation, all of which impact the power producing capability of the system. However, beginning in the 1980s, constraints on the operation of the system for the purpose of aiding the downstream migration of juvenile salmonids were implemented.

[22] Average regional hydroelectric generation is about 16,000 average megawatts based on a seventy-year historical water record.

[23] This estimate is based on an annual average wholesale electricity price of about $28/megawatt-hour [is that price correct?]and assumes a bypass spill operation as identified in the NMFS 2008 FCRPS BiOp.

[24] See Appendix A in the 2003 ***Columbia River Basin Fish and Wildlife Program***.

[25] It should also be noted that the cost of all other non-power hydro operations in 2001 were equally affected by the high electricity prices.

[26] More detailed information regarding generating resources can be found at http://www.nwcouncil.org/energy/powersupply/Existing%20Projects%20101008_web.xls.

Figure 1 shows the average monthly change in hydroelectric generation for the revised Program relative to a "pre-1980" operation. On average, implementing the 2009 Program will substantially decrease generation in all months except June, July and August. That is because from June through August, the Program calls for water releases from behind the large headwater storage dams in order to increase river flows downstream and improve survival for migrating anadromous fish. The resulting generation increases during these months, however, is reduced due to fish bypass spill provisions, which route water over spillways and not through the turbines at mainstem Columbia and Snake River dams.

Figure 1
Average Monthly Changes in Hydroelectric Generation

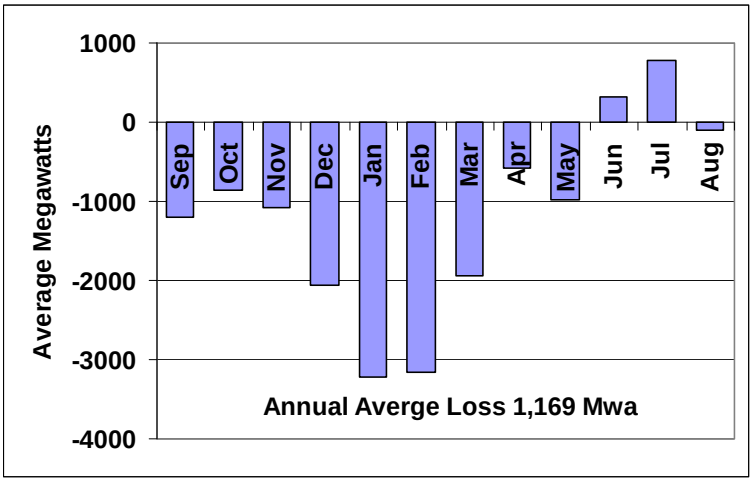

Figure 2
Average Monthly Costs

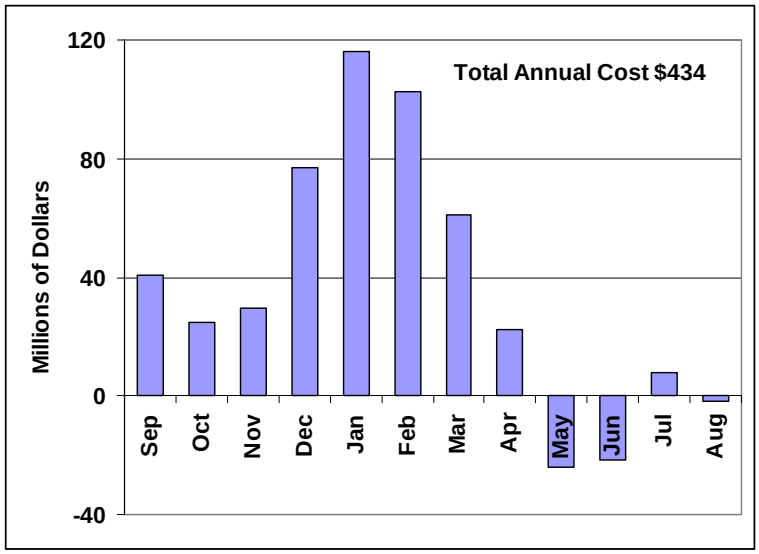

Figure 2 summarizes the average monthly cost of the Program relative to a "pre-1980" operation. Positive values in Figure 2 reflect regional costs and negative values represent benefits. Generally, the cost of a particular change in hydroelectric system operation is inversely proportional to the change in generation, so the pattern in Figure 2 is similar but reversed from that in Figure 1. In other words, an operation that causes a decrease in generation usually represents a cost to the system. However, this pattern is not exactly the inverse because cost depends on electricity prices and they depend on available generation. For example, May shows a decrease in average generation in Figure 1 yet shows a net revenue increase in Figure 2. This is because a reduction in the available generation during that month will cause electricity market prices to increase. Thus, even though less energy is available for sale, it is being sold at a higher price and produces higher revenues. A more detailed description of how cost is assessed is provided below.

Cost is determined by first assessing the expected monthly secondary sales or market purchases (in megawatt-hours) for both the Program and pre-1980 cases over each potential water condition. The secondary sales or purchases are converted to dollars by multiplying the associated energy by the expected monthly electricity price. The expected electricity price will vary by water condition and by hydroelectric system operation. The price is further adjusted to take into account peak and off-peak effects. This matrix of electricity prices (one for the Program and one for the pre-1980 case) over twelve months and 70 water conditions is multiplied by the matrix of energy sales or purchases. The monthly cost or benefit is averaged across all water conditions and is then summed over all months to yield the $434 million average annual cost.

Adequacy

The Council measures resource adequacy in terms of the likelihood of its ability to meet future demand requirements.[27] If that likelihood falls below the agreed upon minimum value, then the power supply is deemed to be inadequate. This assessment is done with a sophisticated computer model (GENESYS[28]), which simulates the operation of the regional power supply system on an hourly basis over many different future conditions.[29]

The minimum acceptable level of adequacy (that is, the minimum threshold for the likelihood of being able to meet future demand) can be translated into simpler metrics that can more readily be compared to load/resource balance sheets.[30]

On average, about 75 percent of the Northwest's electricity is produced by the hydroelectric system.[31] Unfortunately, reservoirs behind the dams can only store about 30 percent of the average annual river flow volume. Thus, annual water management becomes a critical part of resource planning. What this means is that the Northwest must plan for both peak hourly needs (such as during cold snaps or heat waves) and also for annual energy needs.

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[27] In April of 2008, the Council adopted its Pacific Northwest Resource Adequacy Standard. The standard and background information can be found at http://www.nwcouncil.org/energy/resource/Default.asp.

[28] See http://www.nwcouncil.org/genesys/.

[29] Future uncertainties are modeled as random parameters in the assessment and include water supply, temperature and demand, forced outages on thermal generating resources and wind generation.

[30] Such resource and load balance sheets are produced by the Bonneville Power Administration (White Book) and by the Pacific Northwest Utility Conference Committee (Northwest Regional Forecast of Loads and Resources). It should be noted, however, that adjustments must be made prior to comparisons with these reports.

[31] Average hydroelectric generation is roughly 16,000 average megawatts and the region's average annual load is about 21,000 average megawatts.

The metric used to assess the annual adequacy of the power supply is defined to be the available average annual generating capability minus the average annual load, in units of average megawatts. The standard calls for the power supply to at least have sufficient capability to cover the expected average annual load, assuming some availability of market supply and non-firm hydroelectric generation.[32]

The metric used to assess the peak hourly adequacy of the power supply is the surplus capacity reserve margin, which is defined as the surplus generating capacity (maximum capacity minus peak hour load) divided by the peak hour load, in units of percent. The minimum threshold for the capacity reserve margin is 23 percent in winter and 24 percent in summer.[33]

Table 1 shows the annual (energy) and hourly (capacity) adequacy thresholds and the current assessment for 2011 and 2013. The annual load/resource energy balance is well above the minimum for both years, which means the likelihood of a serious curtailment due to a lack of supply is extremely low. It should be noted that the minimum thresholds do not address the issue of price volatility. That issue will be treated in the development of the sixth power plan but generally, the higher the load/resource balance the lower the likelihood of electricity price spikes.

The capacity reserve margins for both winter and summer, for both 2011 and 2013 are above the minimum thresholds. In 2013, however, the gap between the assessed reserve margin and the threshold is only 5 percent, which translates into about a 1,400 megawatt capacity reserve for the summer months. This means that if no resource acquisition actions are taken (and demand continues to grow), the region is more likely to experience summer supply problems first.

It should be noted that both the energy and capacity assessments were done assuming existing resources only. Adding utility planned resources makes the surpluses larger, which improves the adequacy of the system.

Table 1
Pacific Northwest Resource Adequacy Assessment
(RM = peak duration generating **R**eserve **M**argin)

Energy (MWa)	**2011**	**2013**	**Min Threshold**
Annual	2,600	1,900	0
Capacity (% RM)			
Winter	46%	40%	23%
Summer	34%	29%	24%

Summary and Conclusions

Based on our analysis, in the near-term, i.e., over the next 3-5 years, the region is expected to have an adequate, reliable and efficient power supply. This is largely the result of still-depressed demand for electricity and a large number of new power plants that have recently entered service or are under construction here in the Northwest and elsewhere in the West.

[32] The current assessment assumes an average of 200 average megawatts of market supply and 1,100 average megawatts of hydroelectric generation (over the critical period generation).

[33] These thresholds are determined by a 5 percent loss of load probability analysis done with the GENESYS model.

The economical objective is somewhat more questionable. Bonneville and other utilities in the Northwest are facing more difficult financial issues. The Northwest economy continues to be in recession and, while increased *retail* electricity prices are not the primary cause, they have been a contributing factor. Bonneville is facing the need to cut costs and either increase rates or risk higher probabilities of being unable to meet its Treasury repayment. Bonneville's current financial situation is, for the most part, attributable to problems with the structure and operation of the power system. Although the annual cost of fish and wildlife operations did not put Bonneville in this position, it also certainly does not help Bonneville's financial status in the short term.

In the longer term, assuring the region an adequate, efficient, economic and reliable power supply will depend on the successful resolution of a number of issues: These include:

- The adequacy of financial or regulatory incentives for the development of new resources, both generation and demand-side;
- Mechanisms to increase the responsiveness of retail demand to increases in wholesale prices;
- The adequacy of mechanisms to ensure investment in cost-effective levels of new efficiency resources;
- Removing barriers to ensure adequate resource diversity to mitigate risk;
- Taking actions to ensure that variable resources are incorporated appropriately into the power system, without compromising adequacy, reliability, economy or efficiency.
- Development of mechanisms to ensure equitable treatment of fish and power during extreme dry years.

These issues will be addressed in the sixth power plan. With successful resolution of these issues, an adequate, efficient, economical and reliable power system can be assured with the fish operations embodied in the Council's revised Fish and Wildlife Program. It is the Council's mandate to produce a power plan that reduces costs whenever possible, while at the same time maintaining protections for fish and wildlife in the Columbia River basin.