

*Guide to Tools and Principles
for a Dry Year Strategy
(2016)*



Guide to Tools and Principles for a Dry Year Strategy

Background:

In August 2002, following the events of the energy crisis of 2000 and 2001, Bonneville Power Administration (BPA) issued a draft *Guide to Tools and Principles for a Dry Year Strategy (Guide)*. In 2006, the *Guide* was finalized. The intent of this *Guide* is to guide BPA through future critical periods marked by abnormal conditions such as drought, volatile market prices, and/or significant reductions in the availability of power. In 2008, the *Guide* was incorporated into the 2008 BiOp in the reasonable and prudent alternative 14 – Dry Water Year Operations:

“BPA will implement, as appropriate, it’s *Guides to Tools and Principles for a Dry Year Strategy* to reduce the effect energy requirements may pose on fish operations and other project purposes.”

The final 2006 *Guide* was intended to be applicable through fiscal year 2011 when the then current power sales contracts (PSCs) expired. After that point, load service obligations and the Dry Year Strategy would be reassessed. Since 2006, new PSCs (Regional Dialog power sales contracts) have been signed, and during the past six years BPA has improved its power planning and the needs of the Federal power system during dry year(s) have been better defined.

New Power Sales Contracts and Improved Power Planning

In December 2008, BPA executed Power Sales Contracts (PSCs) with Federal agency, Public agency, and Tribal utility customers under which BPA is obligated to provide power deliveries from October 1, 2011, through September 30, 2028. Under these contracts, the Federal Power System has been fully allocated under critical water conditions¹ and fully subscribed to these customers. Additional load service can be placed on BPA at specified times during the rate period (or power purchases can be made from other power sources). However, additional load service will be served by other resources and priced at the cost of those resources.

Starting in 2010, BPA has improved its ability to more comprehensively plan and assess the power system to meet long term load obligations through both a Needs Assessment and Resource Adequacy analysis. The latest Needs Assessment studies are included in the 2015 White Book. BPA has resuscitated its Resource Program, last issued in 1992, to plan resource development based on the needs identified in the Needs Assessment.

The 2015 Needs Assessment analysis examines five planning metrics that are used by BPA’s Resource Program (which identifies potential actions BPA could take to meet any identified needs) including both a monthly HLH P10 metric and an 18-hour capacity metric. The 2015 Needs Assessment focused on the Federal system surplus/deficits for FY 2021 and 2024. The most limiting metric for 2021 and 2024 is the Monthly P10 HLH metric². In all scenarios

¹ Critical water conditions are when the PNW hydro system would produce the least amount of power while taking into account the historical streamflow record, power and non-power operating constraints, the planned operation of non-hydro resources, and system load requirements. BPA considers critical water conditions to be the eight month critical period of September 1936 to April 1937. The water year beginning in August 1936 and ending in July 1937 is not the driest water year in terms of January to July run-off at The Dalles as 5 percent of the water years in the 80 year record have lower water volumes.

² The monthly P10 (10th percentile) Heavy Load Hour metric games water conditions, CGS forced outages, and load and is a point of an inventory distribution from least to greatest surplus (deficits). At P10, only 10 percent of the games have less monthly surplus (deficits).

examined under this metric, BPA faces HLH deficits at the 10th percentile in winter and late summer as a result of primarily low water conditions³.

The 18-hour capacity metric indicates that the Federal system has an 18-hour capacity surplus in the winter and summer⁴. Therefore, the BPA system is limited by energy and not capacity.

BPA's 2016 Resource Program is underway at this time to determine how BPA will fulfill resource needs identified in the Needs Assessment. The 2013 Resource Program relied exclusively on achieving the conservation targets set out in the Northwest Power and Conservation Council's 6th Power Plan and market purchases.

The 2015 Resource Adequacy assessment looked at several metrics for years 2021 and 2024. First, a set of metrics was analyzed based on the National Energy Reliability Corporation pilot program. Second, the Resource Adequacy assessment also examined two draft metrics: (1) annual loss of load probability (LOLP)⁵; and conditional value at risk (CVaR).

The LOLP results for 2021 and 2024 are 6.9 percent and 8 percent respectively. These results are outside of the "acceptable" range of the Annual LOLP Standards of 0 to 5 percent that BPA is presently considering. These results do not include additional resources to serve incremental loads above the base Federal power system that are in the load forecasts as these purchases have not been made at this time. However, if BPA and its customers acquire additional resources as required by the PSCs to serve these loads then the Annual LOLP will drop to 3.5 percent in 2021 and 3.2 percent in 2024.

The conditional value at risk (CVAR metric) examines the distribution of energy not served (ENS)⁶ in the 5 percent of the 4,560 simulated games (228 games) that have the highest ENS amounts. The results for 2021 and 2024 conclude that winter load in January and February has the largest amounts on ENS (over 500 aMW for 2021 in January⁷). In looking at the water year selections for the 25 games with the highest amounts of ENS (a narrower set than the 228 games), the results point to specific water years of the 80-year record that are part of multiyear drought periods. Table 1, below, summarizes the 25 games with the highest annual ENS which were caused by 5 of the 80 water conditions simulated: 1931, 1932, 1937, 1945, and 1993. All of these water years with the exception of 1937, are part of multiyear droughts.

Table 1 – Water Conditions in the 25 games with the highest ENS

³ For example, the Needs Assessment expected case for 2021 has a -1,300 aMW deficit in January and a HLH deficit of -300 aMW in August II.

⁴ For example, the Needs Assessment expected cases for both 2021 and 2024 have a 1,150 MW capacity surplus in winter and a 500 MW capacity surplus in summer.

⁵ The number of games with significant load not being met divided by the total number of games.

⁶ The model records on an hourly basis the amount of load that is not served (Energy Not Served).

⁷ One of the primary differences between the Needs Assessment and the Resource Adequacy analysis is that the RA analysis assumes access to power markets – 1,000 MW in the winter and 500 MW in the summer. This market assumption is included in the 2016 Resource Program.

Water Year	2021 Occurrences	Jan-July Runoff at The Dalles (MAF)	Exceedance	Prior Water Year	Jan-July Runoff at The Dalles (MAF)	Exceedance
1931	10	64.3	64%	1930	70.9	92%
1932	5	108.2	41%	1931	64.3	97%
1937	2	69.2	95%	1936	90.3	71%
1945	1	83.4	79%	1944	60.2	98%
1993	7	89.1	77%	1992	72.7	90%

The conclusion of the Needs Assessment and the 2015 Resource Adequacy analysis is that BPA cannot meet load in all circumstances without taking emergency actions. However, with appropriate planning including allocating the Federal power system out on a critical water basis, developing and implementing a Resource Program that plans to meet power needs in all but the worst conditions, and developing a dry year strategy to assist meeting load in the driest conditions, BPA can minimize the occurrence that emergency actions will have to be taken. This is consistent with the Dry Year Strategy Principles.

The Needs Assessment and the Resource Adequacy analysis can also inform BPA on the type of dry year tools that would be most helpful. Tools that can provide energy primarily during the winter period and also in late summer would be most beneficial. Tools that can provide energy during these periods over multi-year periods may also be helpful as the worst simulations for not meeting load occur in multi-year drought periods. On the other hand, BPA is capacity surplus, and capacity tools are not as useful to provide solutions to these types of problems.

Scope

This guide is a proactive planning effort to ensure that BPA is prepared to meet its load obligations in a cost effective manner should a dry year(s) occur. The results of the Needs Assessment and Resource Adequacy analysis indicate that in a dry year(s) the BPA system could lack energy to serve load obligations during the winter and late summer periods. Therefore these tools focus on energy and principles needed to temporarily solve (up to one year) an energy shortage due to the lack of water (energy) or the unanticipated loss of generation (for example, if the Columbia Generating station trips off-line for an extended period). However, the Guide is not designed to solve local capacity problems due to transmission outages or congestion or non-power constraints nor is it designed to plan for long-term power purchases of resources for the Federal power system.

As shown in figure 1, dry year tools can be used in conjunction with or in lieu of fishery operations to either increase the energy supply or reduce the load demand. This guide focuses only on the formation of dry year tools and the principles for meeting the load obligation and not on the application of fishery obligations. The alternatives of meeting the shortage using fishery operations are addressed in other forums (see salmonrecovery.gov) and the Technical Management Team (<http://www.nwd-wc.usace.army.mil/tmt/>)

Triggering Conditions for the Guide

Throughout the years with abnormally low water conditions, BPA incorporates into its regular planning the periodic review of these tools. BPA may also review the Guide in response to specific events that have the potential to impact Federal or regional load resource balance. Over the past 14 years since the draft Guide, during for years of low water conditions it has been impossible to create, in advance of the dry year(s), a meaningful and prioritized list of events that would trigger the use of dry year tools. The individual circumstances associated with a dry year and the relative cost and availability of tools all impact the appropriate response. Therefore, dry year tools are needed on a short notice and can be used any time to temporarily solve energy shortages that threaten the ability of BPA to meet its load obligation. The dry year tools are subject to the following dry year principles.

Dry Year Principles

The dry year principles serve as the overarching criteria for decisions regarding what tools are used to meet the load obligation in a cost-effective manner. These criteria are intended to embody the most important mandates contained in the 1980 Northwest Power Act as well as other important legislation governing FCRPS including a reasonable and prudent alternative in the BiOP. BPA, in coordination with the Federal Action Agencies (U.S. Army Corps of Engineers and the U.S. Bureau of Reclamation) and other regional stakeholders, when feasible will attempt to satisfy the set of principles in a balanced fashion. It is understood that tradeoffs are unavoidable when operating a large, complex hydropower system that serves multiple purposes.

BPA will make decisions on what dry year tools to pursue to maintain power system stability and reliability while meeting other statutory responsibilities, including responsibilities to:

- Balance both non-power and power uses during the energy shortage;
- Maintain Federal trust responsibilities;
- Protect fish and wildlife consistent with the Endangered Species Act, the 1980 Northwest Power Act, Biological Opinions, and other laws;
- Act in a sound and businesslike manner;
- Provide an adequate, efficient, economical, and reliable power supply;
- Provide a cost-effective solution to the energy shortage to maintain rates as low as possible to minimize the economic impact on the region and the FCRPS

Timeframe

The scope of this Guide is applicable until the year 2028 when the current load obligation contracts expire.

Dry Year Tools

This section of the Guide is considered a living document. The potential tools, the quantity available of increased generation or reduced demand, and the price will be evaluated once a dry year is triggered. The tools have been arranged alphabetically rather than by the quantity of the resource available, the price of the resource, or the priority for employing the tool. The potential for these resources are fluid as are their prices and therefore will have to be evaluated once a dry year is triggered.

1. *Columbia Basin Project Water Conservation*. Enter into agreements with the U.S. Bureau of Reclamation and the irrigation districts to leave project land fallow, capped at some percent in order to limit disruption to the local agriculture economy.

Approximately 4 acre-feet of water per acre of land left fallow would remain in the main stem Columbia River to improve flows and increase power generation. This would also save energy by reducing energy consumed pumping water from Lake Roosevelt to Banks Lake. This program would have to be triggered early in January/February before irrigators enter into investments and contracts.

2. *Direct Service Industry (DSI) Load Buy-down.* The last remaining aluminum smelters in the Pacific Northwest (PNW) at Intalco and Wenatchee works are temporarily idled. As a result, at this point in time there is no potential for a load buy down. However, the tool remains on the list in case there are DSIs when the tool may need to be used.
3. *Distributed Generation.* During the power crisis of 2000-2001 several PNW utilities developed small generating plants. Most have been retired, but there are several remaining. Also, several end-use industrial customers may have idled generation.
4. *Energy Efficiency.* The first focus is on conservation measures that BPA has in the latest resource program portfolio and specifically on increasing the incentives, marketing, and outreach. The second focus is on measures that are not currently cost effective or are emerging technologies. On the residential side, there are residential behavior change pilot programs in the PNW that could be implemented as full programs so that energy savings could be implemented fairly quickly. Refrigerators and freezers that are dropping out of the BPA program due to Federal standards could be brought back in fairly quickly. On the commercial side, BPA has a strategic energy management program with savings unique to the buildings they are installed in. Several measures are expiring due to increasingly efficient baselines be could be brought back into the program including LED case lights in the grocery sector, rooftop unitary air condition units, and LED traffic lights. There are also several emerging technologies such as CO₂ heat-pump water heaters, smart thermostats, ductless heat pumps combined with heat recovery ventilators, and packaged heat pumps.
5. *Industrial Load Buy-down.* There are large industrial end-use customers of PNW utilities particularly in the pulp and paper industry that could substitute market purchases (such as buying pulp as opposed to grinding) or to temporarily shut down processes or machines. The price and quantity of opportunities depend in part on the economic conditions of the commodity products that these mills produce.
6. *Irrigation Load Buy-down.* Enter into agreements with BPA's eastside customers to reduce irrigation pump load (either aquifer or surface water lift). Note that this program has to be triggered in January/February before investments are made in planting.
7. *Market and Option Purchases.* There are power products available in power markets that can be used to meet BPA's load obligations, but prices and quantities available may not always be advantageous.
8. *Power Exchanges.* Power from one utility is exchanged for power from other utility systems diurnally or seasonally and the rates of exchange can differ. For example, California peak load occurs in the summer while the PNW loads peak in the winter.
9. *Public Awareness Campaign.* This can be acted on alone or as a first step before a regional curtailment is enacted. The amount of energy conserved by eliciting public request in hard to quantify.
10. *Storage Agreements.* Storage agreements between BPA and Canada (or other utilities with storage reservoirs) to store / release water to improve power generation during the

period of crisis. This would reduce power production in one period in exchange for another.