Fact Sheet

April 2013

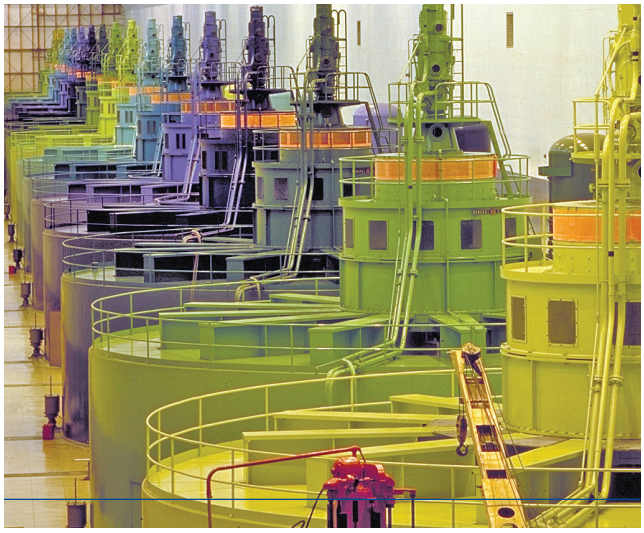
Marketing Hydropower

From energy analysts to traders to schedulers, it takes a team effort at BPA to move low-cost electricity from one of the most powerful rivers in North America to utilities serving Northwest homes and businesses.

Hydroelectric power drives the Northwest and the Bonneville Power Administration sells about 30 percent of the electricity consumed in the region. For many of us, our relationship with electricity is limited to flipping the light switch and paying the bill. But what happens behind the scenes to make it all possible?

Let's take a look at how things work at BPA. First, it's important to note that BPA is a wholesale utility. That means the agency sells power to other utilities and some large industrial or government customers, but not directly to residential customers — the people with all of those light switches. BPA is also unique in the region in that it is a nonprofit federal utility. The other utilities in the Northwest are primarily investor-owned companies or public utilities operated by a city, county or, especially in rural areas, as a cooperative.

Secondly, BPA's power supply comes primarily from two energy resources. The vast majority of the electricity marketed by BPA is hydropower generated by the 31 federal dams on the Columbia and Snake rivers. Up to about 10 percent of the power marketed by BPA comes from the Columbia Generating Station in Richland, Wash., the Northwest's only nuclear plant. BPA offers some of the lowest electricity rates in the country for this carbon-free power.



Hydroelectric generators turn the power of the Columbia into energy for Northwest homes and businesses.

What goes on behind the light switch?

BPA's customers are the utilities that provide power directly to individual residences and businesses. And just as those utilities are responsible for ensuring that power gets to each of their customers' homes, BPA is responsible for ensuring that there is enough electricity to meet the demands of its utility customers, who rely on reliable, low-cost federal power. BPA provides different services depending on the contract specifics and the type of customer. Public utilities in the Northwest, by law, have first right to BPA's federal power. Some customer utilities rely entirely on BPA for all of their power needs. BPA ensures these "full requirements" customers get every megawatt needed. Because electricity production

must always match demand to maintain the reliability of the power and transmission system, BPA tracks the energy consumption and automatically adjusts the production of power up or down as needed to keep the system balanced. In practice, at BPA this most often means operating more or fewer turbines at the dams in the Columbia River system.

BPA also serves "partial requirements" customers, those who own, or have access to some generation to meet their needs, but rely on federal power to make up the balance. Direct Service Industries, or DSIs for short, are another class of customer. These large industrial sites take energy directly from BPA to power their operations. BPA currently serves an aluminum smelter and a paper mill, both classic examples of Northwest DSIs.

At the other end of the customer spectrum are power marketers. These companies don't have residential customers and may not even have generators. They can buy and sell power as a commodity, acting as intermediaries between producers and the utilities that serve end users. They make their money based on the difference in the value of electricity at different places or different times. BPA also buys and sells power through marketers.

BPA sells the power generated by the Bureau of Reclamation's Grand Coulee Dam on the Columbia River, the largest hydroelectric producer in the nation.

The examples above generally reflect a traditional approach to power sales in which a defined amount of energy is sold at a set price: dollars per megawatt hour. BPA also offers a unique and non-traditional product called Slice. In this model, the customer pays for the right to an undefined and variable amount of power. The amount of power a customer receives is based on the generating capability of the federal system as well as the decisions the customer makes about water management using a computer simulation with all the real-world constraints of the hydro system built in. Even though Slice customers have some amount of self-determination under this construct, BPA and its federal partners always retain full control of the power system.

While BPA's various power customers differ, they all have one thing in common: They require electricity. But how much, and when?

BPA sells power in a number of ways

Some customers have long-term contracts that specify how much power they will receive from BPA for years to come. Some of these contracts last as long as 20 years. Other purchasers may want to buy energy a few months in advance, perhaps to lock in a price that is expected to rise, or to provide energy during maintenance on one of the utilities' own generators.

Some shorter-term power sales are for the remainder of the current month. Others may be for a week, a few days, a portion of a day or even an hour. It depends on the purchaser's specific need. This is surplus power that is not required to meet BPA's other contractual obligations.

In addition to the cost that a purchaser pays for energy, there is a separate charge for moving it across BPA's transmission system — a network of over 15,000 circuit miles of high voltage line throughout the Northwest — kind of like a shipping fee. Transmission charges are managed by a separate organization within the agency. This separation is a regulatory requirement to ensure that all transmission customers have fair access to the federal transmission system.

The dedicated professionals at BPA help keep the lights on.

Energy is produced and consumed simultaneously. To keep the power system working, production and consumption must always be in moment-to-moment balance. Utilities pride themselves on providing reliable power, which requires having energy resources lined up well in advance.

However, unforeseen events, as well as the instantaneous nature of power production and consumption, require that energy be available for sale or purchase on an hourly basis. These events may be the loss of a generator due to the failure of a part, for example, or even an inaccurate temperature forecast. If it's colder than expected and all of a utility's customers turn on their heat, the demand for power will be higher than anticipated. This is when BPA and others turn to the hourly or "spot" market.

In fact, the inevitable errors in forecasting energy needs lead utilities to have a little more or a little less energy than they need in any given hour. Of course, if they own generation, it may be possible to adjust production. But utilities also buy or sell in the hourly market to ensure generation constantly matches the demand for electricity.

So, how is all of this set up?

At BPA, teams of energy analysts conduct exhaustive studies to estimate how much electricity the agency will produce to sell at a certain time, and how much its requirements customers will need. The difference in these amounts is how much power BPA can sell on the market, or how much it needs to buy.

Planning far in the future helps the agency estimate which way the energy pendulum is expected to swing: surplus or deficit. While there are many uncertainties factored into forecasts that look out over a decade, as the period shortens to months, weeks, days and hours, precision increases.

As forecast periods shorten, power system planners and the traders responsible for buying and selling energy work closely to determine whether BPA will have an energy surplus or deficit. If it's a deficit, traders can purchase electricity to fill the gaps. If they foresee a surplus, they sell.

Usually a day, but sometimes several days, before the power is needed, the pre-schedule team will work

to schedule energy. This happens after the traders complete necessary power purchases or sales. The pre-schedule group implements these transactions. Scheduling means reviewing trades with customers, ensuring there is space to move the energy across the wires and making sure all of the details of each contract have been met. Specialized computer tracking tools called “e-tags” allow all of the parties involved in an energy transaction — and there can be many — to track it on the Internet. Each party involved in each transaction is distributed a copy of the e-tag. When the pre-schedule staff has completed its work, it hands off all schedules to the real-time schedulers.

During each day from hour to hour around the clock, the real-time team helps ensure the system stays in balance. Real-time is comprised of hydro schedulers, marketers and transmission schedulers who work as a cohesive team to ensure BPA can meet all of its operational and biological objectives. Biological objectives are river flow and water management actions to protect endangered fish and other aquatic species in the river system. The hydro scheduler will establish the expected generation levels at dams throughout the federal system, and analyze if BPA needs to purchase or sell any energy to maintain the supply and demand balance throughout each hour. The marketer and transmission scheduler work together to complete any sales and purchase orders from the hydro scheduler. Together this team manages the variability accompanying a forecast-based system, while facing challenges ranging from fish protection requirements to unexpected transmission line or generation outages within the hour. In fact, quite a bit of the flexibility in the federal hydropower system is used to make sure that when those unexpected outages occur — or even if a generator just produces more or less energy than expected — the federal system can respond to keep supply and demand in balance.

So the power that illuminates our light bulbs at home may have been purchased years or hours in advance. And scores of dedicated professionals have worked hard to make sure it’s available whenever it’s needed in homes and businesses across the Northwest.