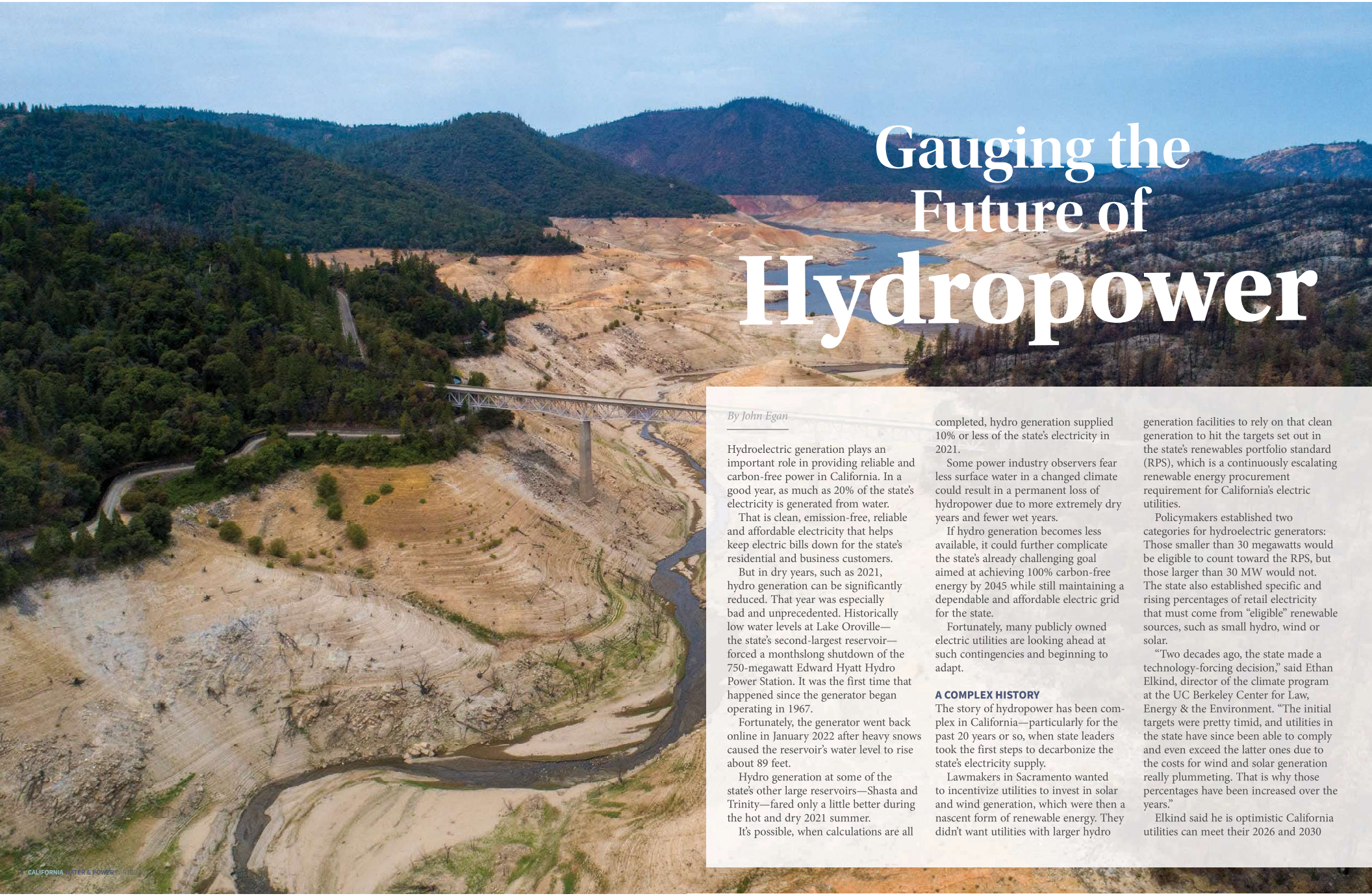

Gauging the Future of Hydropower

By John Egan

Hydroelectric generation plays an important role in providing reliable and carbon-free power in California. In a good year, as much as 20% of the state's electricity is generated from water.

That is clean, emission-free, reliable and affordable electricity that helps keep electric bills down for the state's residential and business customers.

But in dry years, such as 2021, hydro generation can be significantly reduced. That year was especially bad and unprecedented. Historically low water levels at Lake Oroville—the state's second-largest reservoir—forced a monthslong shutdown of the 750-megawatt Edward Hyatt Hydro Power Station. It was the first time that happened since the generator began operating in 1967.

Fortunately, the generator went back online in January 2022 after heavy snows caused the reservoir's water level to rise about 89 feet.

Hydro generation at some of the state's other large reservoirs—Shasta and Trinity—fared only a little better during the hot and dry 2021 summer.

It's possible, when calculations are all completed, hydro generation supplied 10% or less of the state's electricity in 2021.

Some power industry observers fear less surface water in a changed climate could result in a permanent loss of hydropower due to more extremely dry years and fewer wet years.

If hydro generation becomes less available, it could further complicate the state's already challenging goal aimed at achieving 100% carbon-free energy by 2045 while still maintaining a dependable and affordable electric grid for the state.

Fortunately, many publicly owned electric utilities are looking ahead at such contingencies and beginning to adapt.

A COMPLEX HISTORY

The story of hydropower has been complex in California—particularly for the past 20 years or so, when state leaders took the first steps to decarbonize the state's electricity supply.

Lawmakers in Sacramento wanted to incentivize utilities to invest in solar and wind generation, which were then a nascent form of renewable energy. They didn't want utilities with larger hydro generation facilities to rely on that clean generation to hit the targets set out in the state's renewables portfolio standard (RPS), which is a continuously escalating renewable energy procurement requirement for California's electric utilities.

Policymakers established two categories for hydroelectric generators: Those smaller than 30 megawatts would be eligible to count toward the RPS, but those larger than 30 MW would not. The state also established specific and rising percentages of retail electricity that must come from "eligible" renewable sources, such as small hydro, wind or solar.

"Two decades ago, the state made a technology-forcing decision," said Ethan Elkind, director of the climate program at the UC Berkeley Center for Law, Energy & the Environment. "The initial targets were pretty timid, and utilities in the state have since been able to comply and even exceed the latter ones due to the costs for wind and solar generation really plummeting. That is why those percentages have been increased over the years."

Elkind said he is optimistic California utilities can meet their 2026 and 2030

Located near Oroville Dam, Edward Hyatt Powerplant is an underground, hydroelectric, pumping-generating facility located in Butte County, California. Construction of the plant was completed in 1967. The power plant went offline in 2021 because of severe drought. Photo courtesy of California Department of Water Resources

Ethan Elkind, director of the climate program at the UC Berkeley Center for Law, Energy & the Environment, says hydropower's future is uncertain from a water availability standpoint.

RPS goals because conditions to support success are there: clear policy goals and research and development. But some industry observers believe the farther out on the horizon you look, hydropower's role in the future becomes less certain—from both a policy perspective and a water availability standpoint.

As a goal, it is state policy that both eligible renewable resources and other zero-carbon resources make up 100% of electric retail sales by 2045. Although the law doesn't explicitly say large hydro is considered a zero-carbon resource for the purpose of complying with the 2045 timeline, in modeling done for the "SB 100 Joint Agency Report: Charting a Path to a 100% Clean Energy Future," the California Energy Commission defined large hydro generation as a zero-carbon resource.

It is conceivable California policymakers could make further changes to the state's renewable and zero-carbon laws, impacting how large-hydro logically fits in.

Amid California's record-setting 2021 fire season, policymakers and leaders appear to be feeling intensifying pressure to accelerate the state's clean energy goals. Last summer, Gov. Gavin Newsom tasked the state Air Resources Board with studying the feasibility of moving up the state's economywide greenhouse gas reduction goals to 2035.

Beyond policy uncertainties, Elkind said California and the West might expect to receive much less rain and snow, potentially punctuated by extreme rainfall. Elkind noted the West has been in a megadrought the past 15 years.

"The climate science has been pretty clear in recent years that the West is entering a new regime for rainfall and snowpack, which will have a significant impact on hydroelectric generation," Elkind added. "All of this makes planning for hydroelectric generation an unreliable exercise."

An August 2021 analysis from the Bulletin of the Atomic Scientists elaborates on this growing challenge: "While California's generation mix has started to incorporate more renewables and energy storage, these resources are not yet sizable enough to compensate for a significant reduction in hydroelectricity generation, which typically makes up 15% to 20% of the state's electricity supply in non-drought years."

To compensate for climate change, California must adjust operational practices of its hydroelectric reservoirs to adapt to updated water release schedules that anticipate more variable inflows rather than historical inflow patterns, the analysis found.

"If California plans its zero-carbon electricity system based on historical hydroelectricity availability, but gets less availability because of climate change, the state may either not meet its zero-carbon electricity goals or run the risk of blackouts," The Bulletin predicted.

DIFFERENT SOLUTIONS REQUIRED

All utilities in California are situated uniquely based on local needs and communities. For example, the path forward on renewable energy in some parts of the Bay Area is different than in the Central Valley, which is different from the Imperial Valley.

Jim Stack, senior resource planner for the City of Palo Alto Utilities, said even before state RPS regulations went into effect, the utility was taking its own look at renewable energy and liked what it found.

CPAU needed additional generation at that time and was able to sign power purchase agreements with solar developers for electricity at about 3 cents per kilowatt-hour—a favorable price.

According to CPAU's Power Content Label, the utility has historically obtained power from Central Valley Project hydroelectric facilities through a contract with the Western Area Power Administration, as well as the Calaveras hydroelectric project.

Generation from large hydro facilities could be a better value than other renewable options, but because it would not count toward CPAU's RPS goal, that made it a less economically attractive alternative, Stack said. If CPAU signed contracts with large hydro producers, it also would have to buy renewable energy credits just to meet the RPS.

Even though hydropower is relatively inexpensive, Stack said there are concerns about its environmental impact and its ability to perform in the face of California's changing climate.

"In the last few years, we have been able to find very favorable new resources—typically solar and wind—and we expect to sign more PPAs for eligible renewable resources in the future when we have additional needs," Stack said.

REVENUE IN THE BALANCE

Even if hydropower continues to be a large part of the energy resource mix for some communities, complexities around it and state policy likely won't resolve anytime soon.

Willie Whittlesey, general manager of the Yuba Water Agency, doesn't like to use the word "penalty" when discussing how the state's RPS has cut into his revenue stream. But whether it's called a penalty, or a loss of a premium, he still is coming up short.

The agency has no retail electric customers and sells wholesale hydropower from roughly 400 MW of hydroelectric generators it owns and operates on the Yuba River and its tributaries.

It generates tens of millions of dollars annually from those sales, with some of that revenue reinvested back into critical projects for Yuba County's communities. Funded activities include projects to reduce flood risk, ensure a sustainable water supply, reduce the threat of megafire in the watershed and enhance water education.

It could be more, but for the rules of the state's RPS.

"Yuba Water Agency's hydropower sells for about the same as power generated from natural gas," Whittlesey said. "But electricity generated from small hydro facilities carries a $10- to $15-per megawatt-hour premium compared to power generated from gas or other resources that don't count toward the RPS."

For no particular reason, it's more valuable.

Scrapping the large hydro prohibition in California's RPS law would not make the premium vanish, but Whittlesey estimated it would shrink to $3 to $5 per MWh.

"The RPS makes retail electric customers pay more than they need to for their power," he said.

Power generated from large hydro facilities does not reflect the full value of the resource, Whittlesey added, noting large hydro facilities provide the capacity and ancillary services enabling integration of intermittent renewable resources, such as solar and wind, into the California market.

"What happens when the sun doesn't shine? There's hydro," Whittlesey said. "What happens when the wind doesn't blow? There's hydro. Our 400 MW of hydro can go from zero to full capacity in as little as eight minutes. We're not getting fully compensated for the value of hydro, and our communities are losing out." CWP

"WHAT HAPPENS WHEN THE SUN DOESN'T SHINE? THERE'S HYDRO. WHAT HAPPENS WHEN THE WIND DOESN'T BLOW? THERE'S HYDRO."

—WILLIE WHITTLESEY
GENERAL MANAGER OF
THE YUBA WATER AGENCY