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Western drought steals clean energy along with fresh water at power plants

By Todd C. Frankel April 26, 2015

INSIDE HOOVER DAM — The floor rumbled under Mark Cook. His legs vibrated as he stood in a tunnel tucked into the thick base of Hoover Dam, 430 feet below the tourists looking out over Lake Mead. Beneath him, water roared through steel pipes 13 feet tall. Nearby, heavy turbines hummed with mechanical intensity.

“We’re moving some good water today,” Cook, the dam manager, said proudly.

Moving water means making electricity. But the drought is making that harder to do. The lack of water has put a serious crimp in the hydroelectric line at Hoover Dam and other power plants across the West, limiting an inexpensive and pollution-free energy source that once was considered endless.

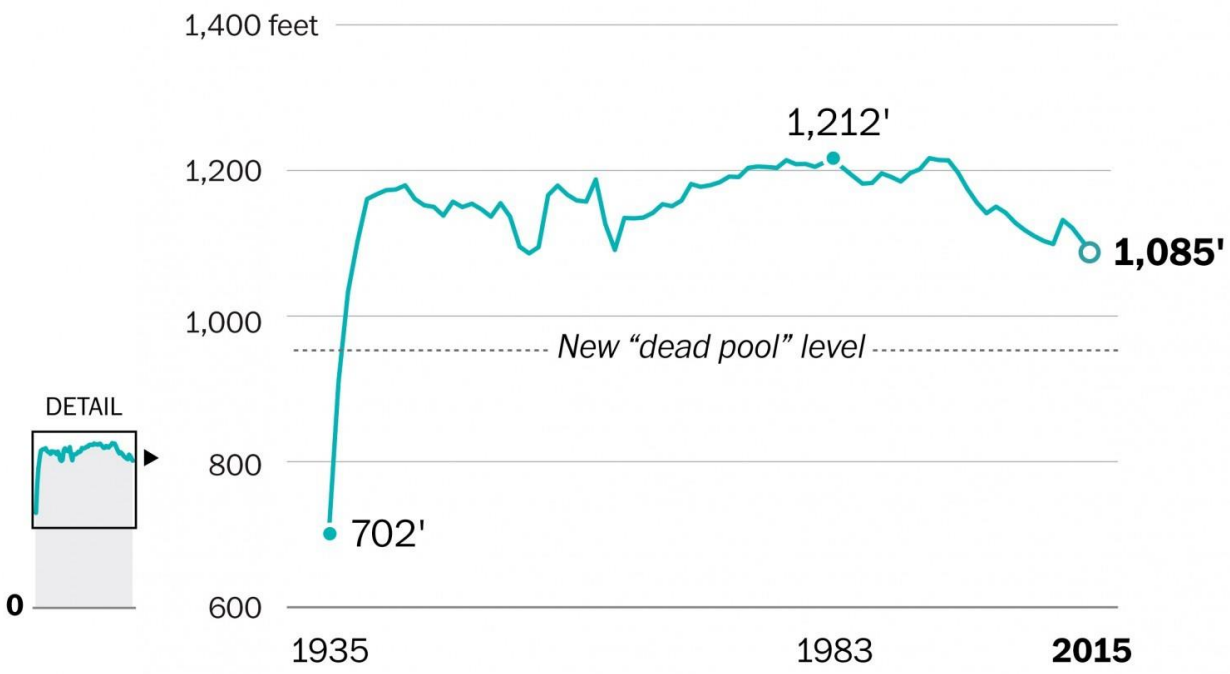
Power capacity at Hoover Dam, on the Arizona-Nevada border, has dropped nearly 25 percent since 2000. In California, home to 287 hydroelectric plants and where almost half the state today is classified as being in “exceptional drought,” hydropower has fallen 60 percent in the past four years.

“The drought is taking a toll on power generation,” said Mike Connor, deputy secretary of the Interior Department.

Short on water and power

Engineers worried the lake would hit a 1,050-foot “dead pool” level, where the water is too low to efficiently turn the dam’s turbines, but new turbines will allow the dam to operate with 100 fewer feet of water.

Lake elevation in March since 1935, the year the dam opened



The lake’s highest elevation is just more than 1,225 feet in July 1983.

Source: U.S. Bureau of Reclamation

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Some power companies in California have raised rates as they turn to pricier, often dirtier energy sources. That makes it harder to reduce the greenhouse gases some blame for worsening the drought in the first place.

Meanwhile, the risk of brief summertime blackouts could rise: Hydroelectric plants often are called upon to help urban power grids deal with sudden spikes in demand.

The problem can be traced to shortages of rain and snowpack, which lead to shallower rivers and reservoirs, which result in less pressure to speed the water along. Slower water simply packs less punch. So turbines spin more slowly, generating less electricity.

Some small facilities, such as those along the Truckee River in northern Nevada, have shut down. Other plants are open but struggling. The 53 hydropower facilities run by the U.S. Bureau of Reclamation across the West are producing 10 percent less power than a few years ago, despite rising demand.

Oregon and Washington are dealing with droughts, too, but so far hydropower in the Pacific Northwest has held steady, power managers say. Water levels in that region's vast Columbia River basin remain close to normal thanks to heavier precipitation along its headwaters in British Columbia, according to the Bonneville Power Administration, which delivers power to Oregon, Washington, Idaho and Montana.

Lake Mead lies in the Colorado River basin, which has been mired in drought for more than a decade. Tree-ring studies suggest this is the region's fourth-worst drought in 1,000 years.

Once the largest U.S. water reservoir, Lake Mead has faded to fourth place as it has lost water. In 2008, a Scripps Institution of Oceanography research paper asked the provocative question, "When Will Lake Mead Go Dry?" The study predicted the lake had a 50-50 shot at achieving that fate by 2021, given current trends.

"The system is in deep trouble," said Tim Barnett, one of the study's lead authors.

California's drought is just four years old. But the drop in the state's hydroelectric production has been precipitous. Hydroelectric sources are projected to contribute just 7 percent of the state's power this year, down from 23 percent in 2011.

While natural gas use has gone up during that period, renewable energy sources such as solar and wind have mostly filled the hydropower gap. California officials think the state can avoid power interruptions during peak hours and even meet long-term environmental goals despite hydropower's decline.

But the hydroelectricity will be missed, said Robert B. Weisenmiller, chairman of the California Energy Commission. “It’s a great resource when we have it,” he said.

At Hoover Dam, the biggest worry is hitting “dead pool” status: The point at which the water level sinks too low to efficiently turn the dam’s massive turbines.

For years, engineers thought that Lake Mead would be “dead” when the waterline slumped to 1,050 feet above sea level. The turbines would spin roughly, rattling the dam’s base. Power generation would need to stop. And a structure hailed as an engineering marvel — called the greatest dam in the world when it was finished in 1935 — would cease to perform one of its primary functions.

Those worries have grown as the lake has shriveled. At its peak during a rain-soaked 1983, Lake Mead sloshed above 1,225 feet. Today, the receding water has left telltale white rings more than 100 feet up on the rock canyon walls.

Inside Hoover Dam, manager Cook walked past a reminder of the trouble he faces: A sign posted on a bulletin board listing decades of Lake Mead elevations.

The trend was distinctly downward. In June 2014, the lake hit 1,081 feet, a record low. This summer the lake is projected to set another record, at 1,073 feet.

But dam workers no longer worry about hitting the 1,050-foot dead pool. In the mid-2000s, as the drought settled in, they began planning to install new turbines that could deal with slower-moving water. Fearing lower lake levels were part of a long-term trend, they wanted to engineer a way around the drought’s effects.

Cook recalled that when the drought eased off briefly in 2012, dam workers wondered whether they needed to install the new equipment. But thankfully, Cook said, the first of the five new wide-head turbines was installed later that year.

Hoover Dam has 17 turbines split between powerhouses on the Arizona and Nevada sides of the canyon. Inside the Nevada powerhouse, the latest $3.5 million wide-head turbine is being installed. It's the fourth of five and should be generating power later this year.

"It doesn't look that different," Cook said, standing near two men working on the turbine, "but it behaves different."

The new turbines should allow the dam to continue generating power even if Lake Mead drops to 950 feet, Cook said. But a water level that low, he said, would be a sign of almost unimaginable environmental catastrophe, so the loss of hydroelectric power would be the least of anyone's worries.

On that score, Cook is an optimist, however. He said he can imagine Lake Mead filling back up, if only briefly.

"It'll just take a few years of really good rain," he said.