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Climate change challenges power plant operations

By [Juliet Eilperin](#), Published: September 9

BOULDER CITY, NEV. — Drought and rising temperatures are forcing water managers across the country to scramble for ways to produce the same amount of power from the [hydroelectric grid](#) with less water, including from behemoths such as the Hoover Dam.

Hydropower is not the only part of the nation's energy system that appears increasingly vulnerable to the impact of climate change, as low water levels affect coal-fired and [nuclear power plants](#)' operations and [impede the passage of coal barges along the Mississippi River](#).

“We're trying to manage a changing climate, its impact on water supplies and our ability to generate power, all at once,” said [Michael L. Connor](#), commissioner of the Bureau of Reclamation, the Interior Department's water-management agency. Producing electricity accounts for at least 40 percent of water use in the United States.

Warmer and drier summers mean less water is available to cool nuclear and fossil-fuel power plants. The Millstone nuclear plant in Waterford, Conn., [had to shut down one of its reactors](#) in mid-August because the water it drew from the Long Island Sound was too warm to cool critical equipment outside the core. A twin-unit nuclear plant in Braidwood, Ill., needed to get special permission to continue operating this summer because the temperature in its cooling-water pond rose to 102 degrees, four degrees above its normal limit; another Midwestern plant stopped operating temporarily because its water-intake pipes ended up on dry ground from the prolonged drought.

Scott Burnell, a spokesman for the Nuclear Regulatory Commission, said the safety of America's nuclear plants “is not in jeopardy,” because the sources of water cooling the core are self-contained and might have to shut down in some instances if water is either too warm or unavailable.

“If water levels dropped to the point where you can't draw water into the condenser, you'd have to shut down the plant,” he said. The commission's new chairman, [Allison](#)

[Macfarlane](#), has asked her staff to look at “a broad array of natural events that could affect nuclear plant operations” in the future, such as climate change, Burnell added.

For more than three-quarters of a century, the [Hoover Dam](#) has represented an engineering triumph, harnessing the power of the mighty Colorado River to generate electricity for customers in not just nearby [Las Vegas](#) but as far away as Southern California and Mexico.

But the bleached volcanic rock ringing Black Canyon above Lake Mead, the reservoir created by the dam, speaks to the limits of human engineering. Higher temperatures and less snowpack have reduced the river’s flow and left the reservoir [103 feet below elevation](#) for its full targeted storage capacity, which it last came close to reaching in 1999.

In the Colorado River’s 100-year recorded history, 1999 through 2010 ranks as the second-driest 12-year period, yielding an average of 16 percent less energy.

Scientists have just begun to study some key questions, such as the rate of evaporation off dams’ storage facilities. Predicting river flows — which can flood one year and dry up the next — is even harder.

“Because of the variability of river systems, it’s a lot more difficult in modeling how climate change will affect them,” said Jenny Kehl, who directs the Center for Water Policy at the University of Wisconsin at Madison’s School of Freshwater Sciences.

In Nevada, water managers are adjusting to what they call “the new normal.”

Patricia Mulroy, who oversees the operations of the Southern Nevada Water Authority, since 2003 has imposed watering restrictions on golf courses and homeowners and increased water reuse from golf courses while also instituting an incentive program that to date has paid residents \$200 million to pull out turf and replace it with water-efficient vegetation. (Enough turf has been ripped out to lay a stripe of sod stretching three-fourths of the way across the planet; overall, she has reduced total water use by a third in 10 years.) She has raised water rates four times in less than a decade while activating long-held water rights in east-central Nevada in 2004 to ensure that the community is less dependent on the Colorado River.

While some experts have suggested more ambitious measures — such as curtailing growth, making it harder for farmers to get cheap water and removing some dams to allow the Colorado River to regain some of its natural flow — federal, state and local authorities have resisted such proposals.

University of Arizona law professor Robert Glennon, author of the book [“Unquenchable: America’s Water Crisis and What to Do About It,”](#) describes the Colorado River basin in blunt terms. “It’s a collision,” he said.

Rising temperatures have started to affect U.S. coal plants as well. This summer’s drought disrupted the transport of coal delivered by barges on the Mississippi, and the U.S. Army Corps of Engineers had to use dredges to deepen the navigation channel.

The Illinois Environmental Protection Agency granted special exceptions to four coal-fired plants and four nuclear plants this summer, allowing them to discharge water into local waterways that was hotter than the federal clean-water permits allowed. Normally the discharge water cannot exceed 90 degrees, but the waiver allowed utilities to release water as hot as 97 degrees.

And environmental groups such as the Sierra Club have questioned whether new coal plants should be built in areas that could face water scarcity. In August 2011, the Lower Colorado River Authority—which oversees a river confined to Texas’ borders—postponed indefinitely its decision to provide 8 billion gallons of water to cool the proposed White Stallion Energy Center, and rejected it outright three months later. While the Sierra Club argued the plant would use too much water, local authorities said contract changes prompted their decision.

At the Hoover Dam, which hasn’t run at capacity since 1983 because of lower river flows and other water demands, the Bureau of Reclamation has taken several steps to compensate for the decline in water availability. The dam loses between 5 and 6 megawatts of capacity for every foot in elevation Lake Mead uses, meaning this year it lost the equivalent of a medium-size power plant.

Aaron Muehlberg, the Hoover Dam’s engineering supervisor, walked through its operations recently and highlighted the mix of antique details and modern improvements that mark the plant. Massive original pipes coated with coal-tar enamel still channel the water speeding through them at the rate of 3,400 cubic feet a second. (“Imagine 3,400 basketballs flying past you,” Muehlberg said.) But it also has updated online controls on the governor that regulate the speed of water around the turbines.

Last year the engineering team installed a wide-head turbine that is 3 to 7 percent more efficient; it will replace an additional four of the plant’s 17 turbines over the next four years. By 2015 the bureau will have put in 11 sets of thinner “wicket gates” that control the flow of water around the turbines: the steel mechanism is akin to a set of circular venetian blinds, and the new ones allow the water to move faster.

“We’re able to jam-pack more water in there, which will give us more energy,” Muehlberg said.

The bureau’s most recent projections suggest that in the next 50 years, the lower Colorado River’s flow will decline between 9 and 10 percent because of climate change, with demand exceeding supply by more than a third. At the same time, it estimates it will take [between 3 and 10 percent more water to meet agricultural demands](#).

In the past, the agency has compensated for a gap in water supplies with sufficient storage, said Terry Fulp, the bureau’s acting regional director for the lower Colorado basin. “Now, the question with the projections we have now is, is storage going to be enough? Probably not,” he said. “We need to start thinking of not just relying on this river system,” he said. Fulp is overseeing a study of the basin’s future supply and demand; the findings will be released in November.

Water managers can start by doing things “that are not too hard and not too expensive,” Fulp added. “But you can only do those things for so long, and then you need to get serious about bigger solutions.”