GUEST JUICE

The Water-Derived Energy Crisis

By Lon W. House

"And it never failed that during the dry years the people forgot about the rich years, and during the wet years they lost all memory of the dry years. It was always that way."

—John Steinbeck, East of Eden

While California weathered the energy crisis of 2000-01, more or less, there is another impending crisis: the approaching water shortage.

We have been living on borrowed time in California. In an "average" water year, California is approximately 2 million acre-feet short of water for consumptive usage. We've gotten by because the last decade has had above-normal precipitation in Northern California. But things are changing.

Power from Glen Canyon down 40 percent.

It is axiomatic that life requires water. Water in California is determined by its climate and geography. About 75 percent of the total annual precipitation occurs north of Sacramento. About 80 percent of the consumptive use in California occurs south of Sacramento. In our Mediterranean climate, precipitation occurs primarily in the winter but the use of water is primarily in the summer. These facts mean that water has to be stored and shipped via the most extensive water transport and distribution system ever created in human history. And this requires energy, lots of it.

Water pumping and treatment is the single largest consumer of electricity in California. It uses more than 7 percent of all electricity consumed in the state, and more than 5 percent of the peak demand.

There has been a convergence of events that have ominous overtones. First is the devastating drought in the Southwest. This has been classified as a 500-year drought, equivalent to the one that destroyed the Anasazi culture in the Four Corners area.

Why does what is happening in the Southwest affect us in California? California is the single largest water rights holder on the Colorado River, entitled to 4.4 million acre-feet annually. When the Colorado River was originally allocated via the Colorado River Compact of 1922, it was based on annual inflows of slightly more than 15 million acre-feet/year. Basically, the upper-basin states get half of the water, and the lower-basin states (California, Nevada, Arizona, and Mexico) share the other half. (An acre-foot is 325,851 gallons. An average California household uses between one-half and one acre-foot each year.)

As it turns out, that allocation was based on a string of unusually wet years. The current drought has reduced the Colorado River inflows to an average of 5.4 million acre-feet for 2001-03. We have been meeting our annual water allocation from the Colorado by draining the river's storage. Lake Powell is at 40 percent of capacity and Lake Mead at 54 percent—the lowest they've been since they were built. Negotiations are under way to get California and the other lower states to agree to less water, with the supplies coming out of Lake Mead, which is not as depleted as Lake Powell. However, that could mean less hydropower for the Golden State.

The energy consequences of this drought are twofold for California. First, we are losing thousands of megawatts of hydropower from the Colorado. Power generation at Glen Canyon Dam is down 40 percent. If Lake Mead drops another 127 feet, power generation there will be threatened. If there is little rain and next year is like this year, Lake Powell will reach its minimum pool next summer and there will be no hydroelectric generation. Reductions of water in storage mean dramatic reductions in the dynamic scheduling available from these facilities.

Replacing the water that is unavailable from the Colorado River to Southern California will require increased pumping, either for transport from Northern California or from groundwater basins.

continued on page 9

The Water-Derived Energy Crisis . . . *continued from page 8*

The second phenomenon of concern is climate change in California. I do not wish to wade into the debate over whether climate change is caused or influenced by human activity, or if humankind can even do anything to influence it, but something is happening, and that something is unnerving.

The water system in California is based on 80 percent of precipitation occurring in the winter, primarily from January through March, and most of this precipitation falling as snow in the northern part of the state. We essentially use the Sierra as a giant reservoir, storing the precipitation as snow and releasing it via melting throughout the late summer and into early fall. If the climate change we're looking at persists, the precipitation regime will shift from snow to rain. If California gets the same amount of precipitation (or even more) as we have in this last decade but it occurs as rain, not as snow, we do not have enough surface storage in Northern California to capture the runoff and meet our water delivery requirements.

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Aside from the water quantity issue, climate change has profound energy implications for the state. Not only will hydroelectric generation decrease with less snowmelt, particularly during the critical late-summer months, but we will see significant electrical demand increases from a source we've never seen before.

Water agencies in California have been expanding their storage capabilities. Groundwater storage, where water is spread on the ground and allowed to soak into the underlying aquifer to be stored, has been dramatically increased during the last decade. Many water agencies have more water stored underground than they do in surface storage facilities. The problem is that it requires pumping—a lot of pumping—to extract the water from underground storage. California has never experienced the electrical demand associated with the thousands of these pumps sitting on these fields.

Conservation will be the foundation of any solution, but it does have its limits. Conservation has been a mainstay of California water policy. For example, Southern California has doubled in population during the last 25 years, yet it uses the same amount of water as it did 25 years ago. And conservation does not address the problem of less water being stored because of a smaller snowpack.

Desalinization, or "desal," is the only source of "new" water available to California, and there are dozens of desal facilities planned from the North Coast to San Diego. Desal facilities share two characteristics—the water produced is expensive, and these facilities use huge amounts of electricity. Depending on the size of the facility and the technology used, a single desal plant can consume 30 to 50 MW.

The water community is attempting to address these supply issues, although the magnitude of the problem appears overwhelming at times. There is a growing concern that virtually all of the potential fixes we have for the water shortfall require significantly increased electricity use. It doesn't appear that anyone on the electricity side is looking at or planning for that possibility.

If the Southwest is entering into a long-term drought cycle (as many are predicting), and if California is getting warmer, we could lose hundreds to thousands of megawatts of hydroelectric generation at exactly the same time we experience hundreds to thousands of megawatts of increased power demand from increased water pumping and treatment. The state is unprepared for this contingency.

We have a couple of years of water in storage in California, so we do have some time to work on this issue. And who knows, the heavens may open up and provide us and the Southwest with just the right amount of snow and rain at just the right time of the year to keep on going. But if they don't, and we don't prepare, the consequences could range from painful to devastating.

People can live without electricity. But people cannot live without water.

—Lon W. House, Ph.D., Water and Energy Consulting owner, has been the Association of California Water Agencies (ACWA) energy adviser since 1992.