Story by Danielle Kalisek and Leslie Lee

The energy-water tug of war

Drought exacerbates the paradox of efficiently producing energy while conserving water

1980 — The state has 179 major reservoirs.

1981 — The Sabine River Authority and the city of Dallas sign a contract to move water to the Dallas Water Utilities Eastside Water Treatment Plant from Lake Fork Reservoir.

1982

1983

1984 — A revised Texas Water Plan addresses future demand for water by identifying conservation strategies for increasing water resources.

The energy-water nexus may be one of the biggest challenges of this generation. Making energy requires water, and getting water requires energy. Both are essential.

So what happens when the latest drought pushes Texas' resources near the brink? The electricity, oil and gas industries are all under strain as water supplies wane.

Power generation feels the squeeze

Continued drought, decreasing water availability and increasing water temperatures are affecting power plants, which in turn affects energy consumers throughout the state, according to experts at The University of Texas at Austin.

"If we see this drought continue, combined with this heat wave, we might see power plants throttling back or curtailing their power output to avoid overheating the water," said Dr. Michael Webber, associate director of the Center for International Energy and Environmental Policy in the Jackson School of Geosciences and assistant professor of mechanical engineering at UT Austin.

Webber's graduate student, Ashlynn Stillwell, with the university's Department of Civil, Architectural and Environmental Engineering, said, "Lack of streamflow or declining lake or reservoir levels can mean there is not enough water physically available for power plant cooling. The high temperatures have also increased water temperatures, meaning power plant cooling is not as efficient."

Webber added that with lower water levels, power plants might have to turn off completely because the water isn't available for cooling.

"Consumers are affected when power plants start turning off because of the drought," Webber said. "If it's drought from a heat wave, we might see rolling blackouts, and we might see power price spikes."

Webber's and Stillwell's research focuses on analyzing power plant cooling technologies for mitigating water management challenges such as drought and high temperatures.

Generally, Stillwell said, thermoelectric power plants burn fuel in a furnace-connected boiler to convert high-purity water to steam. "Steam is then condensed back into high-purity water using a noncontact cooling system so the process can continue. That cooling system requires large volumes of water."

In a paper published recently in the journal *Environmental Research Letters*, Webber and his team wrote that changing the cooling technologies used by power plants in 11 Texas river basins could reduce the water they divert each year by an amount equivalent to the annual water use of at least 1.3 million people.

Policy changes and conservation are key

In the midst of these new technologies, numerous factors are leading to strained water and energy supplies. Webber noted this during his testimony, "Trends and Policy Issues for the Nexus of Energy and Water," before the U.S. Senate in March.

"While the energy-water relationship is already under strain today, trends imply that the strain will be exacerbated unless we take appropriate action," he said. "There are four key pieces to this overall trend: (1) population growth, which drives up total demand for energy and water; (2) economic growth, which can drive up per capita demand for both energy and water; (3) climate change, which intensifies the hydrological cycle; and (4) policy choices, whereby we are choosing to move toward more energy-intensive water and more water-intensive energy."

During this time, power plants are doing what they can to cope with the drought, Stillwell said. ⇨

As the drought continues, Texas' energy production will be affected by water availability.

TIMELINE OF DROUGHTS IN TEXAS

Drought

1985 — Conservation of water, which is recognized as being more economical than developing new sources of water, becomes a key factor for granting water permits.

1986

1987 — The U.S. Congress passes the Federal Water Quality Act, intending to reduce nonpoint source water pollution.

The Wellhead Protection Program, approved by the U.S. Environmental Protection Agency, is initiated in Texas.

1988

1989

"Unfortunately, the drought and extreme heat have caused high demands for electricity. Meeting that electricity demand (without rolling outages) requires cooling water."

The high temperatures have increased the electricity demand for air conditioning, so some days have set records of peak electricity use, she said, and meeting the electricity demand requires additional power generation.

"Conserving both water and electricity helps manage the situation on the demand side," Stillwell said.

Webber added that both consumers and energy producers must keep conservation in mind.

"Conservation is a pretty cheap solution to mitigate some of these effects and buy us some time while we figure out something better."

Drillers deal with drought

Power plants are not alone in feeling the strain of the drought, said Dave Burnett, director of technology for the Global Petroleum Research Institute at Texas A&M University.

"If you're an oil and gas company right now, you are still able to find wells, drill and get the water needed to get everything done, but you have to work harder and spend more money," Burnett said. "The water that you're using for your oil and gas operations is becoming more and more valuable because there's less of it. So companies have to be a lot more careful about where they get their water and how they use it and how they're preventing contamination of the groundwater resources.

"As the drought becomes more and more serious, the concerns about the existing groundwater resources become greater and greater. You want to protect what's left."

In some Texas cities, such as Grand Prairie, drought-induced water restrictions have prohibited gas companies from using city-owned water for hydraulic fracturing of gas wells.

"Companies are realizing that they have to be very aware because they are members of the community and have to take the communities' needs into account too, when they are finding their water resources," he said.

In addition to treated wastewater, brackish water is another possible water source that drilling operations are beginning to use. However, the need to seek such alternative water sources will affect oil and gas companies' bottom line and consumers. "The cost of developing the gas shale is going to go up. Water is just one more expense that is going to have to be borne," Burnett said.

"I think that very soon people will begin to realize that brackish water, although not considered a fresh water resource, is valuable too," he said. "Desalination technology is going to make that water usable and can do it for a reasonable price. I think that there will be a movement toward greater use of brackish groundwater. And I think that perhaps the oil and gas industry might lead in that."

Using alternative water sources is just one of many shifts that could occur in many industries if the current drought continues.

When asked if this drought will have policy impacts on oil and gas, Burnett replied, "It will have to. Water has been considered free for a very long time."

Drought

1990

1991 The Texas Clean Rivers Act establishes a state program to reduce nonpoint source water pollution.

1992 The Texas Water Commission declares the Edwards Aquifer to be an underground river; however, the Texas Supreme Court rules this attempt to regulate the Edwards Aquifer unconstitutional.

1993 The Texas Legislature creates the Edwards Aquifer Authority to limit groundwater pumped from the aquifer and ensure adequate continuous flows from the aquifer's two main springs—Comal Spring and San Marcos Springs, home to endangered aquatic species.

1994