

Amid state's push for solar power, water-supply worries arise

By **Shaun McKinnon** - Jan. 17, 2010 12:00 AM

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Arizona can offer [solar-energy](#) developers legendary sun-drenched skies and thousands of empty square miles but not nearly so ample a supply of a third essential resource.

Water.

As the state vies for a place among the [renewable-energy](#) leaders, seeking the jobs and tax revenue a vibrant solar industry would create, officials face a fundamental and all-too-familiar obstacle that could slow the green power rush.

Some of the most widely used and economical solar-energy technologies require significant amounts of water, as much as or more than the coal, natural-gas or nuclear power plants the solar projects are meant to replace.

Yet the sites most attractive for solar plants, the wide open plateaus and deserts, are also some of the hottest, driest parts of Arizona.

What emerges is an uncomfortable question for a state trying to secure its economic future: Should Arizona support a renewable resource with one that is finite?

Sen. Jon Kyl, R-Ariz., warns that an uninformed embrace of solar power could threaten the state's already uncertain water resources. But others say the conflict is not so clear-cut. Solar energy's benefits - a free fuel source, no [air pollution](#), no hazardous waste - could still balance or even outweigh its demand for water.

Some of those issues are playing out in Mohave County, 14,000 sparsely populated square miles of northwestern Arizona that could have been custom-ordered for solar-power developers.

Stung by the real-estate crash, county officials rolled out a red-carpeted welcome to several large solar projects that could help the state make deep inroads in fulfilling its solar-energy promise. So far four projects have been proposed, and two are on the regulatory fast track and could begin generating power within two or three years.

The first two plants could require more than 1.5 billion gallons of groundwater annually. That's less than would be used by the sprawling subdivisions once planned for the area but still as much as a city the size of Kingman, population 27,000, requires in a year.

"This technology uses gobs of water," said Robert Glennon, a University of Arizona law professor who has written two books about water use. "We are not paying enough attention to energy and its water needs, and solar energy needs a lot of water."

Comparing uses

Water does not come to mind when people think of solar energy. Most picture the photovoltaic panels, common on rooftops, that absorb sunlight and directly convert it to energy.

But photovoltaic arrays can't yet fill large electricity demands cheaply, so most of the big solar projects proposed in Arizona would operate with a technology called concentrating solar.

It uses the sun's energy to create steam that turns turbines to generate electricity, much as traditional power plants do. Water is needed to produce steam and cool the system afterward, as much as twice what an average coal-fired plant uses and, in some cases, more than a nuclear plant uses. The water used for steam can be reused, but much of the rest is lost to evaporation.

In a report on solar energy and water issued last August, the Congressional Research Service illustrated the solar-water predicament neatly with two maps. One shows the regions of the country where water supplies are most susceptible to shortages. The second shows the projected spread of solar-power plants by 2050.

The areas most at risk of running short of water, including much of southern and central Arizona, match up closely with the areas where solar-power projects are expected to develop.

"With all the buzz about renewables, we better be careful that the solar energy we produce is not the sort that requires a great deal of water," Kyl said, "because that is not a renewable resource."

Experts say an important factor to consider in selecting a location for a power plant is the site's existing use.

Some planned projects, including the huge Solana plant proposed by Arizona Public Service near Gila Bend, would be built on land once used for agriculture, often atop deep aquifers. Water is already available - as groundwater rights belong to the landowner - and in most cases, the plants would consume less than the farms they replace.

"If you're really looking at sustainability, solar is a better bet than [agriculture](#)," said Arizona State University researcher Martin Pasqualetti, who studies the link between water and energy. "None of us are eating cotton, which is where we're getting most of the water for these projects. I argue solar will be of more benefit to the state economically."

UA's Glennon said such a reallocation of water from farms to solar power represents a wise choice for Arizona. He warns, however, against the scores of projects staked out on parcels of untouched public lands, where the only source of water is aquifers whose amounts of water are either unknown or difficult to measure. The U.S. Bureau of Land Management is reviewing applications for 33 such projects in Arizona.

The Mohave County projects also would rely on groundwater in areas that have never supported farms or homes. The expected drain on resources has mobilized residents who worry about the strain on a non-renewable source of water.

"Water is gold here," said Denise Bensusan, a community activist who has worked on a water-advisory group. "These companies who want to build here have attached the green label to a project that is not green because it uses a finite resource. When I first thought of solar power here, I never imagined the water it would use."

Mohave County officials say the power plants pose no threat to the region's drinking-water supplies. The projects "will provide excellent jobs and substantial capital investment for our region of the state," said Mohave County Supervisor Gary Watson, and "will better enable us to attract additional renewable-energy projects."

Weighing the options

With few exceptions, state water laws would not prevent a solar-power plant from pumping the groundwater aquifers around it. State regulators hope they can encourage energy providers to build on retired farmland or use more water-efficient technology.

"The problem is if you look at the preferred land locations, you're talking about mostly the western (Arizona) deserts," said Herb Guenther, director of the Arizona Department of Water Resources. "These areas are also the areas of lowest rainfall and the areas where we don't really have that much renewable water."

Arizona has long expected to attract solar-energy developers, and the demand for solar power has grown in recent years, fed in part by local, state and federal tax breaks. Interest spiked when state regulators adopted rules in November 2006 that require utilities to obtain a minimum of 15 percent of their electricity from renewable sources by 2025.

Most of the proposed projects are outside the five areas - Phoenix, Tucson, Prescott and parts of Pinal and Santa Cruz counties - where groundwater use can be limited. Outside those areas, a landowner can drill wells with few restrictions.

Enough water is available in most areas to supply the plants and existing residential and business needs for the immediate future, Guenther said, but all of those uses are depleting a supply that won't last forever.

Kingman is working on a deal to sell its treated effluent to supply the Hualapai Valley Solar plant northwest of the city, the largest of the projects proposed for the region. Company officials say they could [recycle](#) some of the water through the plant almost 60 times.

The Palo Verde nuclear plant west of Phoenix operates almost entirely on treated wastewater, recirculating the water multiple times.

But treated wastewater and on-site [recycling](#) still don't erase the need to monitor the demand for water at solar projects, water experts say, and only offset some of the water needed.

"Even if you're reusing water that has already been used, if it was mined groundwater, you're consuming a non-renewable resource," Guenther said. "Instead of putting the treated effluent back, you're consuming it."

Guenther said he wants to see the state's solar industry grow, but he and other water managers are trying to encourage more discussions about alternative technology, such as dry cooling or a hybrid system that uses less water. Unlike wet cooling, which uses water to cool the steam back into water, dry cooling blows air to cool the steam, though such a system is not efficient in the hottest climates.

"Water is going to have to be a factor in the siting of solar plants," said ASU's Pasqualetti. "We have to decide, 'Do we want to use our water in that way?' Solar uses more water than other sources, but it uses less water than agriculture, so if you're replacing agriculture land with solar, you're going to come out with more water."

Identifying the costs

The question of using a finite resource to support one that is renewable drills to the core of an issue that has befuddled many: What are the overall costs of generating energy?

Solar power uses as much water as other energy sources, but it doesn't pollute the air like coal, doesn't require building long delivery pipelines like natural gas and doesn't leave behind deadly waste like nuclear.

Energy regulators have struggled for years to assign values to an energy source's various advantages and disadvantages, the external costs of generating power. With so much of its focus shifting toward renewable electricity, the Arizona Corporation Commission plans to try again to sort those costs out.

"We're going to be assigning over the next couple of years the monetary values for things like water, carbon dioxide, mercury emissions," said Kris Mayes, chairwoman of the state's utility regulatory panel. "When you start to see those values penciled out, it becomes clear that the biggest costs are associated with fossil-fuel-driven electricity."

In the meantime, Mayes said, the commission will look more closely at proposed solar projects and their need for water. The location and technology of a project - Would it sit on retired farmland or raw desert? Is it exploring dry cooling or a hybrid alternative? - will be considered carefully.

A bigger question, she concedes, is assigning a value to water. "How do you say just how valuable water is in an arid state like Arizona?" she said. "It's like the credit-card commercial - it's priceless."

Kyl said Arizona should decide soon how much of its water resources it will commit to solar energy. His work on a series of tribal water settlements has underscored the difficult decisions the state faces, he said, and he plans to release an issue paper in the coming weeks that will weigh Arizona's options.

He said the Corporation Commission and other regulators have an obligation to protect Arizona's water and suggests they ask questions about water use at each step toward a project's approval.

Some critics also worry that, as plants proliferate, much of the power will be sent out of Arizona, effectively exporting the state's water to its neighbors.

Yet Arizona officials want to avoid overregulating solar-power providers, watching warily events in California. Regulators there have slowed or blocked several proposed plants because of water demands, and late last year Sen. Dianne Feinstein, D-Calif., sought to block development on about 1 million acres of environmentally sensitive land in her state's eastern Mojave Desert. If the limits stick, they could scuttle more than a dozen proposed solar and wind projects.

"We don't want to see that happen in Arizona," Mayes said. "It's also important to remember how much water it takes to fuel nuclear plants and coal plants and natural-gas plants. They all use water. We need to be careful not to overstate the problem."