

California's shift toward renewables makes energy harder to manage

April 2 2015, by Kim Smuga-Otto, San Jose Mercury News

California's electrical grid has a problem - a nice problem, but a problem nonetheless: The state often has too much power.

Nearly 23 percent of California's [energy](#) now comes from renewable sources such as wind and solar, and the state is on track to reach its goal of generating one-third of its energy from renewables by 2020. But feeding all that green energy into the Golden State's grid - without overloading it - has become a major challenge.

That's because the state's aging natural gas plants aren't nimble enough to turn off when the sun starts shining and then quickly switch back on when it gets dark. And while the technology to generate clean energy is growing by leaps and bounds, efforts to store the power haven't kept up.

The dilemma has forced the energy industry to rethink the way we make and use electricity. And utilities are having to recalculate how much they should charge for electricity at certain times of the day.

"I've seen more changes in the past three years than the previous 20," said Eric Schmitt, vice president of operations for the California Independent System Operator, the "[air traffic control](#)" center of one of the world's largest electrical grids. The center is capable of directing more than 50,000 megawatts of electricity - the output of almost 300 average-sized power plants running at full capacity - over high-voltage lines that crisscross the state.

The ISO's home in Folsom looks like a starship's control room in a science fiction movie: 12 horseshoe-shaped tables, each with eight wide screens. A bank of colorful monitors stretches for 80 feet across one wall, flashing graphs, maps and constantly updating reports.

The last time Californians had to think about their [electrical grid](#) was in the early 2000s, when companies such as Enron manipulated energy prices and caused statewide brownouts. Since then, the nonprofit organization that oversees electricity delivery to 80 percent of the state has faded from view.

Since the late '90s, public utilities such as Pacific Gas and Electric have largely gotten out of the business of running power plants. They now buy most of the electricity their customers use from the wholesale energy market.

Roughly 140 companies sell to the market, resulting in about 27,000 transactions per day. The ISO makes sure the purchased electricity makes it to the utilities' substations.

To help explain how the increases in renewable energy affect the amount of electricity available, grid operators have produced a graph they've nicknamed the Duck Curve because of its tail-belly-neck shape. The lines track California's demand for electricity over a single day, subtracting out the electricity supplied by solar and wind.

In the morning, [electricity demand](#) rises as people wake up and turn on appliances, lights and electric toothbrushes. And as the day wears on, the state is increasingly dependent on solar plants, especially in the afternoon.

A recent record was set on March 6, when solar peaked at 5,812 megawatts, five times what it was three years ago. All this solar power is

allowing California to cut back on natural gas - which now provides about 60 percent of the state's energy needs - and other traditional sources of electricity.

But this can be a problem because the sun sets at the same time that people are returning home. That causes electricity use to surge, and the power plants that were turned down or even off need to start producing - fast.

The majority of California's [power plants](#), however, aren't up for the abrupt on-and-off challenge. "A big portion of our fleet is not flexible," said Steven Greenlee, an ISO spokesman. "It cannot be ramped up fast. It cannot start and stop multiple times."

It can take up to a day for a typical electrical generator to go from "off" to being able to add electricity to the grid. And as more solar comes online, the ramp-up curve each evening is getting steeper.

Greenlee said the grid needs [natural gas plants](#) that can respond to increased demand within 10 minutes. This could mean building new plants or retrofitting old ones.

Another quick source of electricity could come from storage - basically big batteries that would discharge to the grid when needed. The storage capacity isn't there now, but the California Public Utilities Commission has mandated that PG&E, Southern California Edison and San Diego Gas and Electric have a combined 1,325 megawatts of storage no later than 2024.

Todd Strauss, PG&E's senior director of energy policy, said there are "lots of engineering challenges behind the curtain," but that the utility is on track to add its 500-megawatt share of storage on schedule.

PG&E is also looking to shift the times of its highest-priced electricity to match when demand is actually the greatest.

The utility now charges its highest rates on weekdays from 1 p.m. to 7 p.m. in the summer. But that's when the sun is supplying a great deal of energy. So the utility has petitioned the PUC to set the time back, from 4 p.m. to 9 p.m., to encourage PG&E customers to delay washing dishes or doing laundry until the demand for energy drops.

While the energy ramp-up may look like the most intimidating problem, a more immediate one is too much [electricity](#) on the grid.

Four times last year, the winds - which usually drop off in the early morning - kept blowing. Grid operators had to order a decrease of 1,700 megawatts of energy or risk damaging power lines.

"We have to take immediate action whenever the grid goes out of balance," Greenlee said. "We can't just wait and see."

Nancy Rader, executive director of the California Wind Energy Association, says that wind generation is usually a balancing force on the grid because it normally gets windier as the sun is setting. "It's going in the right direction at the right time," said Rader, who doesn't see over-generation of wind energy as much of a problem because it's easy to turn off a wind turbine.

And Joe Desmond, senior vice president of marketing for BrightSource, predicts that solar-energy generation will ultimately prove to be more flexible. The Oakland-based company that built Ivanpah in the Mojave Desert - California's largest solar plant - is designing plants for China that can store solar heat and save it for after dark.

Schmitt is also optimistic. The grid operators, he said, are up to the

challenge.

"In California, we're out in front, setting the pace," he said. "We're showing folks how to do this."

©2015 San Jose Mercury News (San Jose, Calif.)
Distributed by Tribune Content Agency, LLC

Citation: California's shift toward renewables makes energy harder to manage (2015, April 2)
retrieved 6 May 2024 from
<https://phys.org/news/2015-04-california-shift-renewables-energy-harder.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.