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THE POLITICS AND BUSINESS OF CLIMATE CHANGE

4. RENEWABLE ENERGY:**Calif.'s famous 'duck chart' is outdated, experts say**

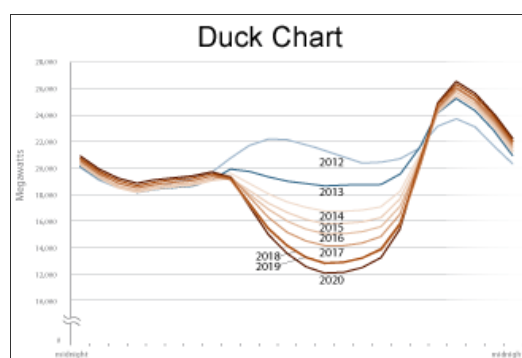
Debra Kahn, E&E reporter

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BERKELEY, Calif. -- A two-dimensional duck has been haunting California policymakers charged with balancing increasing amounts of renewable energy on the state's electricity grid.

The "duck chart" emerged several years ago as grid operators were contemplating the rise of renewable energy, as mandated by state law. It illustrates the drop in daytime demand for conventional power that can be expected as renewables increase their share.

"It's become an amazingly powerful meme," said Matt Barmack, director of market and regulatory analysis for power generator Calpine. He said it cropped up recently at a Federal Energy Regulatory Commission discussion of Northeastern energy markets, completely unrelated to California. "It's sort of taken on a life of its own."



Expanding renewable energy sources in California and lower daytime consumer energy demands have regulators studying the "duck chart." Click the map for a larger version. Graphic courtesy of the California Independent System Operator.

The chart, which represents hourly electricity demand minus the amount of electricity generated by renewables, looks somewhat like a fat-bellied duck. The belly, representing the lowest point of daily demand, drops lower and lower as more renewables come online over time. By 2020, the chart projects midday net load to be only 12,000 megawatts, down from a peak of 22,000 MW in 2012.

One problem with low midday demand is that it can send prices for midday power plummeting. Another problem is that it quickly ramps back up again in the evenings, right as people return home from work and solar generation drops to zero. For California, which is required to get 33 percent of its electricity from renewable resources by 2020, the projections underscore the need for flexible generation that can respond quickly to drops in renewables. Nearly 80 percent of California's renewable portfolio standard is projected to be made up of solar and wind by 2020.

But the duck model overstates the issue, California energy experts said last week at a conference put on by the Berkeley Energy and Resources

Collaborative, a program at the University of California, Berkeley.

"It assumes zero percent of the solar has storage," said Dan Kammen, an energy and nuclear engineering professor at Berkeley and a former renewable and energy efficiency expert at the World Bank. As well, it ignores steady sources of renewable energy, like geothermal and hydroelectric power, he pointed out. "I don't think we will ever see anything like this in reality."

'Not every day is a duck'

In the complex world of electricity markets, the relatively easy-to-grasp chart has taken on outsized importance, one solar executive said.

"I definitely fear the duck chart," said Sheldon Kimber, chief operating officer of solar developer Recurrent Energy, "not because it's real or has veracity, but that it gets out there and it gets into people's minds."

The genesis of the duck is rooted in California's particular concerns about electricity reliability, he said. The California Independent System Operator (CAISO) "has only one role right now, and that's to keep the lights on," he said. "If you tell someone your entire performance is going to be based on keeping the lights on, they're going to tell you we need to build a megawatt of gas for every intermittent megawatt on the system."

CAISO officials defended the chart, saying it reflects the expected technology mix of wind, photovoltaic solar and solar thermal with and without storage.

"Not every day is a duck, but the fact that some days will look like the duck means we have to be prepared to balance the system to cover a broad range of operational conditions," said CAISO spokesman Steven Greenlee.

The chart represents a typical day in March and was recently updated to reflect utilities' latest build-out assumptions, he said. "We have considered a range of simulated conditions, including ones in which wind is blowing and not blowing at night, etc.," he said. "There are other days in the spring and fall that have similar types of shapes."

But natural gas power plant operators and customers aren't necessarily convinced of its relevance.

"The net load of this day peaks at 25 gigawatts," Barmack said. There are "50, 60 or 70 gigawatts lying around to solve this problem that's plenty fast to meet these kinds of ramps."

The flexible capacity doesn't need to be met by new natural-gas-fired plants, utility officials agreed. "We need ramping," said Todd Strauss, senior director of energy policy, planning and analysis for Pacific Gas & Electric. "What can provide that?"

Existing peaker plants, as well as demand-response programs that reduce electricity use or shift it to times of lower demand, could fit the bill, he said. "What's important is to identify the needs and figure out the resources that can provide those capabilities."

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