New headache: over-generation—Perry Sioshansi's Letter from America

As renewables rise, grid operators must rise to the challenge

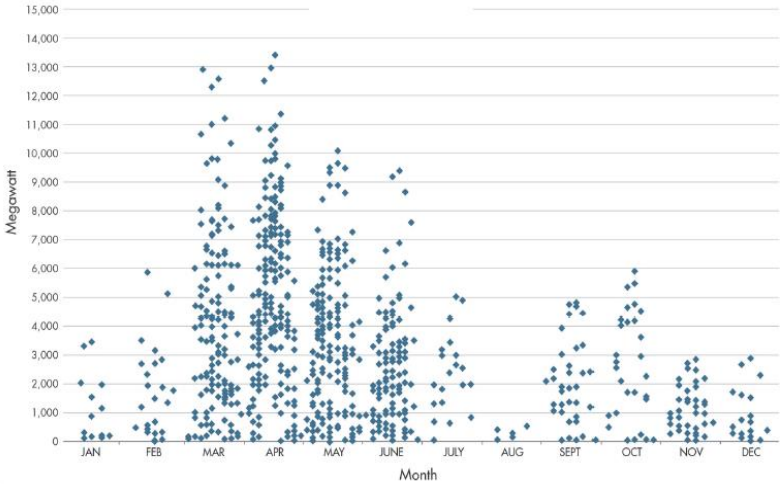
Demand growth in many parts of the world is history. Making matters worse, is a new phenomenon: over-generation, usually referring to intermittent renewables, which—unlike thermal generation—cannot be easily adjusted by an operator. Consequently, when demand is low and there is ample renewable generation—such as during windy and sunny periods—the market operator is faced with more supply than load.

Depending on the circumstances—such as interconnections with neighbouring grids, availability of storage and/or flexible demand programs—the market operator may have no options but to curtail the un-needed renewable generation or refuse to accept the excess generation if that is an option in the supply contract. During such episodes, wholesale prices go negative, which means the grid operator is willing to pay customers to take some energy off the grid—thank you.

This problem was discussed at an early December 2014 meeting of officials from the California Independent System Operator (CAISO), who were briefing the California Public Utilities Commission (CPUC). CAISO presented the results of a hypothetical future scenario for 2024 under a 40% renewable portfolio standard (RPS)—California currently has a 33% RPS target for 2020.

It is called over-generation in California

RPS Curtailment in 2024 under a hypothetical 40% RPS Scenario



Source: Notice of ex parte communication by CAISO, CPUC, 3 Dec 2014

CAISO said that under such a scenario—40% RPS by 2024—it might face as many as 822 hours, out of 1,760 hours in the year, when supply may exceed demand on the network, i.e., over-generation.

What is noteworthy is not just the potential number of hours—not excessive by standards of many network operators with rising renewable portfolios—but the scale of potential over-generation, which may reach 13.4GW during a few hours, most notably in March and April when California demand is relatively low, as illustrated in the graph above.

What can be done about over-generation? Quite a lot

- Modify curtailment provisions in power purchase agreements to reconcile with RPS priorities
- Increase energy storage, demand response, and energy efficiency
- Achieve time-of-use rates aligned with regional and seasonal system conditions
- Deeper regional coordination with other balancing authorities
- Electrification of transportation and related managed charging
- Reduce fleet minimum load burden by increasing fleet flexibility

Source: Notice of ex parte communication by CAISO, CPUC, 3 Dec 2014

What can be done to address such a future? Many who do not favour renewables anyway, on ideological or other grounds, would prefer to panic and/or propose to curtail further growth of renewables.

More sensible minds can usually think of a long list of remedies and options that could address the over-generation problem, especially since 2024 is nearly a decade away. CAISO's own list of potential solutions (*see box left*) is a sensible one to begin with.

As everyone recognises, renewables are inherently intermittent. But so is demand, in the sense that it varies from hour to hour and season to season. The solution to over-generation is to find better ways of matching supply with the load, altering one or the other to keep the system in delicate balance. This editor finds it rather odd that hardly anyone talks about over-demand or too much demand during peak hours, while everyone is now concerned about over-generation.

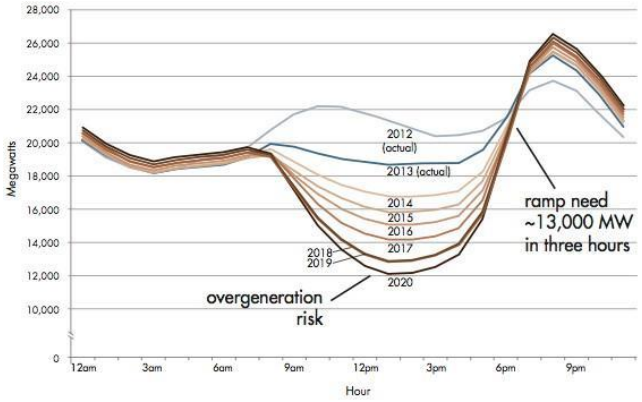
In his inaugural speech in early January 2015, California governor Jerry Brown announced his intention to raise the state's 33% RPS target to 50%. He said his goals for the next 4 years include, "[…] increasing from one third to 50% the electricity derived from renewable sources, reducing petroleum use in cars and trucks by as much as 50% and doubling the efficiency of existing buildings."

The 76-year old Brown, who was being sworn in for an unprecedented fourth term as governor of the nation's most populous state said: "Taking significant amounts of carbon out of our economy without harming its vibrancy is exactly the sort of challenge at which California excels. This is exciting, it is bold and it is absolutely necessary if we are to have any chance of stopping potentially catastrophic changes to our climate system."

Over-generation, if that is the term, is likely to become more pronounced over time. CAISO better get to work on its list of remedies.

California duck

Duck curve illustrates steep ramping needs and expected over-generation, representing net load on 31 March 2013 with projections to 2020



Source: CAISO

Perry Sioshansi is a specialist in electricity sector restructuring. He is founder and president of Menlo Energy Economics and is the editor and publisher of EEnergy Informer, from which we have sourced this article, and which we commend.