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GUEST JUICE

More Wind, More Flexibility

Circuit's April 27 Juice column "More Wind, More Backup" highlights the important issue of how to integrate increasing amounts of intermittent renewable generation into the California grid, while maintaining the reliability of our electric service. But the column would more appropriately have been titled "More Wind, More Flexibility."

The existing capabilities of the California grid are more than sufficient to provide the modest increases in load following and regulation capacity that would be imposed by a 20 percent penetration of intermittent wind and solar resources, according to a new study.

Neither expensive, nor difficult.

The study - to be released soon by the California Energy Commission (CEC) - provides a strong "green light" for the state to move to higher levels of intermittent generation as part of a 33 percent-by-2020 renewables goal. It suggests the task will be neither expensive nor especially difficult, although changes to status quo practices will be required. The study did not consider leaps in innovation, such as plug-in hybrid vehicles and smart household electricity meters, which could further ease the transition toward greater reliance on wind and other renewable resources.

The CEC study, known as the Intermittency Analysis Project (IAP), is a major effort to model the operational impacts on the California electric grid of both the current RPS goal of 20 percent renewables by 2010 and the contemplated goal of 33 percent renewables by 2020. Performed by GE Energy Consulting and other analysts, the study examined the impacts of intermittent renewables across the full range of relevant time scales at which generation is dispatched, from one minute to one day, as well as specific system conditions under which rapid changes in renewable generation might have a significant impact on system operations. The IAP studied a number of scenarios, with up to 12,700 MW of wind and 6,000 MW of solar.

The initial results from the IAP study show that the California grid has the technical capability to include 20 percent intermittent generation under a 33 percent renewable goal without the need for significant new resources to accommodate the variability of these intermittent renewables. Instead, the researchers emphasize the need for the California Independent System Operator to do a reasonable job forecasting the output of intermittent resources, and for the state's energy markets to encourage flexible, load-following operations from the hydro and gas-fired resources that exist on the system today, or those that are planned to replace them.

Thus, not only is the current system infrastructure adequate to handle wind additions without building more dispatchable fossil fuel-fired generation, most of the need for load following and regulation capacity from now to 2020 will be driven by load growth, not by the move to 33 percent renewable generation.

The IAP work notes that there are many choices for increasing the flexibility of the grid to respond to fluctuations in the output from intermittent wind and solar resources: demand response programs, operational changes at hydroelectric and water pumping plants, limited curtailments of renewable generation under specific circumstances, and removing contractual constraints on flexible gas-fired generation. The study indicates that these resources are plentiful

continued on page 4

GUEST JUICE . . . *continued from page 3*

enough that new steel in the ground is not required to integrate up to 33 percent renewables. Modifications to utility contracting practices, CAISO pricing structures, and demand response programs will likely be required, however, along with ongoing analysis of the impacts of integrating increasing amounts of intermittent resources.

A separate and distinct issue is whether additional "back up" generation will be necessary to meet system peak demand in a system with 20 percent intermittent resources operating. The IAP study did not evaluate this issue. Unfortunately, policymakers are being presented with highly simplistic responses to the "back up" issue, based on the low wind generation observed during just a few peak hours in summer months, including the peak hours of the one-in-57-year heat wave that the state experienced last July.

For example, based on this limited data set, Pacific Gas & Electric has proposed to the California Public Utilities Commission (CPUC) that it be authorized to procure additional dispatchable resources equal to 20 percent of its anticipated wind generation, which could amount to as much as 800 MW of back-up capacity by 2016. Using data from just five hours during last year's heat wave, the CPUC's Energy Division has suggested that the contribution of wind generation to resource adequacy requirements should be revised downward. These proposals make no effort to examine in a statistically sound way the likelihood that last year's experience will be repeated, or to assess the value of wind generation across all of the on-peak hours of a California summer.

One of the units of Southern California Edison's San Onofre nuclear plant was off-line for six months in 2000-01 as the result of a fire, at the height of the energy crisis, while the state suffered repeated rolling blackouts. Yet no one has suggested that the state's nuclear capacity should be derated as a result of this poor performance.

The CPUC's current resource adequacy rules appropriately assess the capacity value of wind based on its actual output across all summer on-peak hours. Under these rules, existing wind projects receive capacity credit equivalent to about 25 percent of their nameplate capacity rating; the value will be higher for newer projects with state-of-the-art wind turbines. Stated differently, wind is just as likely to operate during peak demand periods as it is likely to operate overall. Sophisticated studies of the capacity value of California wind resources by researchers from the National Renewable Energy Laboratory, Oak Ridge National Laboratory, and the CAISO have validated these rules.

Viewed this way, wind requires no "back up." Instead, the statistical likelihoods that each resource type will be available to serve load are assessed together to produce an overall reserve margin that reduces to a reasonable level the risk that demand will not be met.

It seems unlikely that any renewable resource will ever match the conveniences that fossil fuels offer (forgetting for a moment the inconvenience of catastrophically roasting the planet). However, if we are smart about how we integrate wind and other intermittent renewables into the grid, we will not need to build significant amounts of new generation capacity - backup or otherwise - to accommodate these resources. Instead, we need to ensure through rules, and/or price signals, that the flexible capabilities of resources on the system today, and those that replace them, are put to efficient use and are not wasted. We also need to push the envelope: as John Bryson, head of Edison International, testified before Congress last month, advanced electricity meters will soon be able to shift consumer consumption to times of peak wind and solar production. And plug-in hybrid vehicles offer enormous potential for charging up when power is abundant and discharging to the grid at times of peak demand.

One-third renewables by 2020 is likely to be a cornerstone of California's effort to reduce its greenhouse gas emissions; fulfilling much of this demand with intermittent resources can be done. Achieving this goal at the least cost to California ratepayers will take a concerted effort. If we're not careful, reliance on simplistic metrics and pat answers for addressing the challenges of intermittency will lead to more costly solutions.

—Nancy Rader California Wind Energy Association executive director & Tom Beach, Crossborder Energy (CalWEA consultant)