More Flexible Thermal Needed as Renewables Grow

Renewables targets have been adopted across the US, with the most ambitious in California, at 33% by 2020, a challenging but achievable goal — the interim 20% target for 2013 was reached ahead of time in 2011. What might prove more difficult, however, is for the rest of the generating fleet to stay in business, as more renewable energy means lower market prices and fewer hours of operation for conventional power plants. This could cause serious reliability issues, Johns Hopkins University’s Benjamin Hobbs said in a recent presentation in New York, as renewables need to go hand-in-hand with flexible conventional energy to make up for intermittency.

High solar generation means multiple ramp-ups and downs for conventional power plants — in a typical winter’s day, in addition to the early morning up and late evening down related to general power demand, they face a sunrise-induced mid-morning ramp-down followed by a steep early evening ramp-up, as sunlight fades while demand grows to reach a dinnertime peak (see graph). Unpredictable wind activity only adds more variability, which needs to be faced with appropriate flexibility, a key attribute of gas turbines — recent models can ramp from sleep mode to full capacity in just a few minutes. In a study released in June, the California Independent System Operator (ISO) showed that about 5 gigawatts of new gas turbines would be needed by 2020 to support 13 GW of new renewable capacity — 8 GW of solar and 5 GW of wind. They would also make up for the retirement of 12 GW of older thermal plants plus the Pacific coast ousted by environmental regulation on the destructive impact of seawater cooling on marine life.

While renewable generators are allowed to sign long-term contracts with the Californian utilities, ensuring full recovery of their capital and operating costs, most fossil-fuel capacity has to rely on the spot market, where noncontracted plants use a tendering system to compete for dispatch. Generators typically bid their variable costs, as fixed costs — mostly debt service and dividends — are spent anyway, so the market usually clears at the variable cost of the marginal megawatt hour — the last and most expensive one demand requires to be satisfied.

Californian spot prices are currently low as gas, the main determinant of thermal plants’ variable costs, is quite cheap. They averaged $31 per megawatt hour for the first eight months of 2012, in line with El New Energy’s calculation of a US open-cycle gas turbine’s variable cost — $34/MWh over the same period — and way below any technology’s full cost of generation — $46/MWh for a US combined-cycle gas turbine (CCGT), the least expensive option. Independent generator Calpine last year considered retiring its 580 MW Sutter CCGT near Sacramento, a state-of-the-art unit commissioned in 2001, citing insufficient spot market revenues, and only agreed not to do so in May after the California Public Utilities Commission ordered the state’s private utilities to negotiate contracts with the plant for the rest of the year — giving state regulators a few months to find a more durable solution. As fuel-free renewable energy’s variable costs are very low, this issue can only get worse for conventional plants when renewable targets are reached (NE Aug.9).

To attract — or retain — enough flexible capacity, Hobbs, who also chairs the California ISO’s independent market surveillance committee, explains that the best economic solution would be for markets to match this flexibility, which would involve removing rules intending at limiting price variability — such as pricing intervals longer than five minutes or the California ISO $1,000/MWh bid cap. This might prove difficult as operators — and their bankers — dislike volatility and extreme price spikes. Other options include capacity markets rewarding availability instead of actual generation — they work well in the eastern US — or the California ISO’s proposed “flexi-ramp”, a new market segment to procure fast-response ramping capacity. The issue is currently under discussion and a decision is expected by year-end, for implementation by the fall of 2013.

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