First Person—Of Oboes and the Public Interest

Viewing the Electric System as a National Asset… and a Finely Tuned Orchestra

For 35 years, Matthew L. Wald has written extensively about energy for *The New York Times*, *Scientific American*, and *MIT Technology Review*. In April, he began work at the Nuclear Energy Institute as a senior director, policy analysis and strategic planning. In this interview with *EPRI Journal*, Wald discusses how optimizing the power generation mix and taking a national perspective can support a robust grid.

EJ: Wind and solar are growing by leaps and bounds because of tax subsidies, state mandates, and improving technology. Where is this leading the grid?

Matthew Wald

Wald: There is a limit to how much is desirable. Consider this analogy. In February in Washington, the National Symphony Orchestra performed the Eroica Symphony. Just as Beethoven specified, there were two oboes, two flutes, two bassoons, three horns, and timpani. If the price of oboes dropped, would the symphony use more of them? Of course not, because the conductor isn't hiring on price. And as it turns out, the price of oboes is pretty stable, at least in relationship to flutes, bassoons, horns, and timpani.

Unlike the Eroica Symphony, the power grid has an oboe problem. Generation works largely on price in most of the country, and the grid is going through rapid price changes. Renewable energy sources are a bit like oboes; they are useful and distinctive. And they are getting cheaper. But how many can the system use? The grid is threatened by the "silver bullet syndrome." In the popular mind, mandated solar and wind will solve our climate woes. But that idea could lead to more intermittent power than the system can assimilate, as has occurred in Hawaii, and soon in parts of California.

When solar is cheaper than coal, coal will disappear without a trace, like the Soviet Union or Pokemon or disco music or some similar bad idea, right?

Well, maybe.

When the electric system runs well, it is like a symphony. You might really like oboes, but making up a whole orchestra of them is going to cause problems.

EJ: So how is the grid's oboe problem being addressed?

Wald: One answer is taking shape in California, though it's not a perfect answer by any means.

In California, renewable energy is part of the state religion. And because it is not dispatchable—that is, it comes when it wants to, not when you want it to—it is threatening to bump up against grid stability.

California might reorganize itself to handle the problem. At the moment it is taking two sensible steps that are opaque to the public.

One is a mandate for 1,300 megawatts of energy storage. Not megawatt-hours, just megawatts. In other words, not energy, just power. The popular conception is probably that these batteries will charge up at night from excess wind power, or at noon with excess solar power, and deliver the energy when the sun is down and the wind isn't blowing. In fact, they will do hardly any of that. Batteries would have to fall in price by two-thirds to three-quarters to be cost-effective for arbitrage—buying and storing power at off-peak prices and reselling it at higher prices.

Instead they're going to provide a quick jolt of power—what the industry calls "ramping"—when the sun sets and everybody comes home and turns on a flat-screen TV and microwave oven. Then the natural gas plants, which were squeezed off the grid in the sunny mid-day, wake up and get back to work.

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I haven't seen a good estimate of the costs of this approach, but they will be ascribed to all ratepayers. These oboes aren't quite as cheap as they look.

The other step California is taking is to coordinate with utilities in Nevada to adjust fossil generation up and down as renewable generation falls and rises. This is also perfectly sensible. But it guarantees that Nevada can't follow in California's renewable footsteps. Nevada will be the shock absorber for the rise and fall of wind and sun, the elephant jumping on the trampoline across the state line.

EJ: What are the risks?

Wald: If these approaches work, they won't cost anything except some money. If they don't work and outages occur, they will result in a few lost jobs at the top and very unhappy utility customers. As William Congreve, who was born 100 years before Beethoven, wrote, "Hell hath no fury like a voter scorned." Or something like that.

The problem with electricity is that it is generally noted only in its absence. People didn't focus on the particulars of the grid, such as transmission lines, state estimators, and tree trimming, until the great Eastern blackout of 2003. That event led the National Academy of Sciences to conclude that while the price of a kilowatt-hour was 11 cents, the value, when not available, was $5.00.

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When the electric system works, it's invisible, but to use a peculiarly literal analogy, it can be the third rail of American politics. In the entire history of the United States, half of the governors whom voters have removed from office were evicted for messing up the power grid. That was Gray Davis in California in 2003. The other was Lynn Frazier in North Dakota in 1921, when electricity was not a factor.

EJ: Aren't renewables essential for a low-carbon, low-emissions system?

Wald: Yes, but achieving lower emissions is not the only goal in our electric system. In fact, there are four goals in conflict, and we could use a better-informed national debate about reconciling them. The goals are a system that is reliable, cheap, clean, and politically appealing. Coal is cheap and reliable; nuclear is reliable and clean; solar and wind are clean and emotionally satisfying. Gas is cheap, sort of clean, and sort of reliable. Hydro is clean and a good dance partner for intermittent clean sources, like wind and sun, but it is not reliable by itself.

You can't draw a Venn diagram where all these things intersect.

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There is, however, an optimum mix. A mix is itself a virtue. In the last 30 years, the electric system has proved durable because it uses a mix. It has struggled through oil shortages, coal shortages, gas shortages, droughts, a generic question about nuclear design, and other blows that have hurt one sector or another of the system. But the system itself has been flexible enough to withstand challenges to its components. This flexibility may become more important as new factors, like carbon control, come into play.

EJ: What is EPRI's role in this conversation?

Wald: EPRI's research indicates that an integrated mix is the best path forward, but this is not high-visibility research.

EPRI, which knows more about the grid than anybody, could be doing more to make electricity visible in ordinary times, to help provide the nail that secures the shoe that saves the horse that saves the battle and keeps the kingdom cooking. EPRI can explain to the public in basic terms how the system works and what's needed to keep it working. Maybe we should re-incarnate Reddy Kilowatt and paint him green.

But talking about these things rationally is hard, because the electric system runs on ingredients that most people don't understand and that become important when you have a lot of renewables. Here's an example: With renewables, power and energy are no longer in tandem. The independent system operators have to cope with power and energy separately, and have to manage voltage support, frequency regulation, and ramping. This stuff is essential but obscure. All of it costs consumers money.

Some of the public ignorance is aided by interest groups. For example, Grid Alternatives, the name of the nonprofit organization that installs solar in low-income communities, implies that rooftop solar frees panel owners from the grid. In fact, debate would be enhanced by a public understanding that the grid is what enables the use of solar. And a robust grid is the only hope for tapping wind.

Expanding the grid will be hard. Most of the opponents are the people who call themselves environmentalists. A better description would be conservationists. They are not really environmentalists. What they favor is stasis. They do not like the industrialization of rural environments for any purpose, from fracking to coal mining to power plant building to transmission. They often show up at hearings on transmission projects as members of the interested public, but interested public can be the opposite of public interest.

EJ: How can power industry stakeholders reframe the conversation to support a robust grid?

Wald: We're not going to solve these problems until we think of the electric system as a national asset and a national issue, and we make decisions with a broader constituency in mind.

A big part of the problem is that if our federal and state governments succeed in their goals, we are guaranteed to fail.

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Consider the public service commissions, which are set up to minimize prices and benefit the people of the state. Meeting national goals takes a national perspective. The people who plan and approve power lines need to think like the people who designed the interstate highways, not like the people who build ships in bottles. If the best way to reduce fossil fuel use in New York is to build a windfarm in the Dakotas and a transmission system to move the energy, then stop erecting government structures that say that transmission lines are neighborhood projects, conceived locally for local goals. If public benefit means cutting carbon, then stop making decisions based on the idea that public benefit means minimizing electric rates. And if electricity industry institutions can't get this idea across directly, it may be time to look to all those organizations that purport to support the environment, and drag them to the table to talk about what's needed.

America has prospered so far partly because its layers of government have favored commerce, promoted stability, and allowed cheap transportation. It's time to do that in electricity.

EJ: What is the role of research?

Wald: There are at least four, and two of them contradict.

One is to build and deploy better hardware like phasor monitoring units that help grid operators run transmission lines closer to their limits without increasing the chance of failure. A second is developing software to help operators visualize the system in all its complexity. A third is to demonstrate the benefits of the grid. In 2000, we were hailing the grid as being the greatest invention of the 20th century. Now we have people saying they are virtuous because they are off the grid. The shift is so fast it can make your head spin. The industry has to explain that the grid is good for the health of the economy and the environment.

And the fourth, the contradictory part, is that research has to show that while improvements will come, we already have the technology to make the grid perform better, and we're paying for our reluctance to deploy that technology. From seatbelts to measles vaccines, sometimes the solution is staring us in the face.

The views and opinions in this interview with Matthew Wald do not necessarily reflect the views of the Electric Power Research Institute.