Viewpoint—Smart Ways to Make a Stronger Grid

Discussions among policy and electricity sector leaders in recent years have at times included the question of whether we should pursue a smart grid or a strong grid. For example, Kennedy Maize wrote in *Power Magazine* in 2013 that he preferred "strong grid" to "smart grid"—emphasizing such aspects as grid resilience and grid hardening. As a simple either-or proposition, the implications would be significant for utilities' strategic plans and capital budgets. As a practical and strategic consideration, many of us see the need to emphasize both.

For everyone engaged in research and development, such questions are important. They get to the heart of our research portfolios, which require thinking that is both comprehensive and focused on very particular aspects of power production, delivery, and use.

Looking at just four of the articles in the July-August *EPRI Journal*, we can examine the question of "smart or strong" in light of EPRI research.

Make Components and Infrastructure Stronger

One *EPRI Journal* story begins from the perspective of Central Hudson Gas & Electric in New York, which in one three-year period was struck by the four worst storms in its history. While the utility's customers and the broader public could acknowledge the magnitude of the challenge, they also looked to the utility to strengthen the grid—and particularly those aspects related to hardening and resilience.

If you like traditional "let's-break-it-so-we-can-make-it-stronger" research, you'll enjoy reading about how we dropped "trees" on power lines with just that goal in mind. Our work has shown that there are incremental but effective improvements that we can make to the familiar poles-and-wires infrastructure to make the power system stronger and more resilient.

The Promise of New Materials

Power plants typically ride out storms in good shape, but a more demanding power system is driving us to search for materials that can withstand higher temperatures and pressure. As variable renewables claim a larger share of power production, many thermal plants will need to ramp their production up and down to balance production, resulting in significant thermal and other stresses on plant materials. Also, we project that a coal-fired plant operating at 1400°F could deliver a 20% emissions reduction and a 24% increase in thermal efficiency relative to the average of today's U.S. coal fleet. In a world in which policy and technology drive us to reduce emissions for the long-term, old power plants and old materials must give way to the new.

EPRI Journal reports on our participation in the Advanced Plant Component Test Facility, which will retrofit a coal-fired facility with nickel alloy components and then operate it at 1400°F for two years. Researchers expect to learn a great deal by putting components through 2,000 thermal cycles.

The Importance of Smart and Strategy

Mark Rothleder's interview can help us put a smarter-stronger grid in perspective. As the California Independent System Operator's vice president of market quality and renewable integration, he has significant responsibilities for addressing that state's integration of solar resources.

He describes rapid supply swings of 1,000 to 1,500 megawatts, predicting such swings will increase in frequency and magnitude. He points to the need for active power control of solar resources, citing a 7,000-megawatt production ramp when the sun rises. System operators will require comprehensive monitoring and control for a grid with more distributed, dynamic resources.

This illustrates the need to develop a strong grid by making a smart grid. Along with that, Rothleder points to what I describe as "strategic strength," built on a principle that EPRI's research has demonstrated for more than a decade: We need the full portfolio of resources. Among others, he describes the roles of efficiency, storage, demand response, and smart inverters.

And if we can align retail rates, market design, and grid resources, we can optimize the grid using much more diverse resources.

Strength from the Customer

To align the power system, its markets, and rates, we must understand first what the customer wants or prefers. EPRI surveyed customers served by Kansas City Power & Light, Salt River Project, and 12 local power companies served by Tennessee Valley Authority (TVA). We looked at rate plans, pricing, and contract length, among other things.

We learned that about a third of the utilities' residential customers prefer time-of-use pricing over a flat rate. We are considering additional surveys to look at service plans and grid-interactive devices such as smart thermostats and water heaters, and researchers are conducting a discrete choice experiment to evaluate customer preferences for rooftop photovoltaics and community solar programs.

From the customer's perspective, much of our research is out of sight and out of mind. But the grid's fundamental strength and the value of our research and development ultimately will be measured by the customer's comfort, convenience, choices, and satisfaction with the products and services provided by the grid and its electricity.

From EPRI's perspective, the customers' needs are never out of sight or mind. Given the emergence of a power system operating with much more dynamic, distributed, and digital systems and components, we see "smart" as essential to "strong." And we are committed to strength as fundamental to every part and aspect of the system.

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