AMERICA'S POWER PLAN

ENERGY EXPERTS UNPLUGGED… VOLUME 9

By Sonia Aggarwal, Eric Gimon, and the experts of America's Power Plan

This is the next edition in a monthly series of short answers to some of the questions we're hearing from public utilities commissions, market operators, utilities, legislators, and other energy decision-makers. Topics are posted at http://americaspowerplan.com/briefing-room/ask-the-experts. Submit your question today by emailing APP@energyinnovation.org.

Q: I've heard that we need energy storage technology to be deployed at scale before the grid can handle more renewables…is that true?

A: No. There are at least five options for managing the variability introduced by renewables like solar and wind, and while energy storage in the traditional sense is a very good option, is not at the top of the list today according to price or availability.

So what else is there that might be cheaper and more available?

First, demand response is a staggering resource whose potential we are only beginning to see. Switches and radios could turn all the buildings in our nation into thermal batteries. By simply pre-cooling or pre-heating, thermostats and hot water heaters can become amazing sources of grid flexibility. Major companies like Honeywell, Johnson Controls, and Google's Nest Labs are recognizing this opportunity and taking action. But regulators and market operators can drive this market by simply beginning to properly value this resource. See ***Aligning Power Markets to Deliver Value*** for specific recommendations on how.

Second, variability declines considerably when diverse resources are balanced over wider geographical areas. For example, the wind blows at different times in California's central valley as on Oregon's coast. Transmission should be used strategically to connect balancing areas with diverse resources. And where balancing areas cannot be fully integrated, energy imbalance markets (described in a **previous Q&A**) can also go a long way to deliver flexibility. **Planning for and Investing in Wires** has important suggestions for how to effectively connect balancing areas.

Third, given the profound changes underway in the electric sector, system optimization can make a tremendous impact. In previous decades, grid operators looked at demand as an independent variable, and dispatched supply to meet it. Now, supply is more variable and

demand is more controllable. Luckily, operational changes and smarter software can go a long way to co-optimize across supply and demand. Activities like dispatching on shorter intervals, defining power market products clearly so that supply- and demand-side resources can bid in to deliver them, and automating grid operations can all help deliver an optimized system.

Fourth, new combined-cycle fast-ramping natural gas plants can also deliver flexibility. America's production of natural gas has been increasing in recent years, as have our estimated reserves, and many have described it as the bridge to a clean energy future. But to effectively use gas as a bridge, integrated power systems can take advantage of gas' ability to ramp production up and down quickly. This is a major benefit that gas has over coal, nuclear, and renewables. Taking advantage of new highly efficient turbines that can deliver flexibility is a smart way to use gas as part of a portfolio. Again, see ***Aligning Power Markets to Deliver Value*** to read more about how to structure power markets to ensure that supply-side resources like gas compete on equal footing with demand-side resources to provide flexibility to the system.

And fifth comes storage in the traditional sense—grid-scale batteries, pumped hydro facilities, etc. Pumped hydro can be a great option in regions with the right terrains. Still, careful consideration must be given to local environmental impacts of pumping and releasing water in fragile habitats. According to the Department of Energy, the cost of battery storage has come down nearly 80 percent in the last five years, and policies like California's storage target (1.3 gigawatts by 2020) are clearing the path for this important technology to march further down the cost curve.

Finally, variability introduced by renewables can be managed by building new flexible demand (chemicals production, for example) to take advantage of excess power during times of high renewable production. As an alternative, renewable power can be curtailed in cases where cheaper solutions are unworkable.

Researchers at the National Renewable Energy Laboratory popularized the concept of a **flexibility supply curve** to bring some order to the way we think about the resources that are available to manage variability. The basic idea is that we should consider our options based on least-cost, rather than on the first ideas that might come to mind—such as natural gas plants or grid-scale battery storage—which may end up being more expensive than some of the other options.

The bottom line is that there are many options for managing the variability introduced by renewables, and there is no need to slow renewables deployment while we wait for battery storage costs to come down.

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