Why DER are key to helping utilities achieve a modernized grid that maximizes renewable integrations

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Over the past few years, the electrical industry has seen new global trends, including decentralization and the addition of distributed generation and distributed energy resources (DER) to local distribution feeders. This trend can be attributed to a variety of factors, including changes in customer expectations, falling costs of renewable generation and environmental policy development, such as renewable portfolio standards. As the grid continues to change, there are plenty of successful examples of DERs providing additional support for the grid, but we've also seen one of the biggest barriers to growth in DER integration: utility business models that have trouble incorporating DER benefits.

Why is that? Why are utilities slow to add DERs to their generation portfolio when the industry can see their benefit?

When looking at the history of the electric grid, DERs are new, and the industry wasn't designed with these resources in mind. Traditional regulatory models limit the returns utilities can make from alternative energy solutions. To help further advance the grid through distributed energy resources, utilities should look to three distinct paths:

- Regulatory change
- Utility business model transformation
- Technical changes surrounding grid modernization

Any of these three large categories can help a utility leverage DERs to improve the reliability and resiliency of their grid while still making a profit.

Regulatory Change

One of the greatest focuses in the utility regulatory space is moving toward a performance-based regulation (PBR) model. Unlike traditional regulation models, the PBR model allows utilities to decouple revenue from energy sales and makes them less vulnerable to load defection. When we transition from a traditional cost-of-service model to PBR, we shift from rewarding an investment to rewarding a set of outcomes. This frees the utility to profitably pursue a broader spectrum of solutions (including DERs) to meet customer needs while simultaneously providing an alternative revenue source.

U.S. utilities have already begun making PBR proposals to their local utility commissions, and many have included incentives around DER customer experience. New York, Massachusetts, and Hawaii have the most established PBR frameworks in place, but there is still a long way to go before PBR becomes the norm. Hawaii is looking to be a pioneer in this area as it moves toward a much broader form of PBR. It is currently carrying out a major collaborative exercise to introduce a comprehensive set of incentives for the grid and is engaging utilities, interest groups and the public to determine the forms those incentives should take.

Utilities are embracing a change from the 'build' mindset to the 'performance' mindset through non-wires alternatives (NWAs). The leveraging of DERs in place of traditional wire-line investments can often be the least expensive and most flexible way to handle increased demand and congestion on the system. NWAs also help combat traditional utility problems such as peak load restraints and aging assets with distributed generation and energy storage. Traditionally, these types of investments have been overlooked because utilities could only profit on wires solutions, not distributed ones. PBR mechanisms such as shared-savings incentives allow both the end customer and utility to keep a portion of the money saved by using cost-effective alternatives to wires investments. This further encourages advanced development of the grid and keeps costs low.

Utility business model transformation

As we enter a future with more DERs, PBR-style remuneration and increased threats to the grid (including extreme weather and cyberattacks), what utilities do will fundamentally change. Whether by regulatory change or market necessity, electric utilities will evolve beyond simply delivering electricity through wires. Utilities will need to balance generation and demand at the distribution level while facing a changing supply mix, greater decentralization of generation, increased use of DERs, and the burgeoning power needs of an electrified transportation sector. A critical component of balancing these dynamic sources and loads will be higher fidelity data on the second-by-second operations of the grid. Data will drive the utilities' ability to balance the network. More than ever, utilities will be in the business of understanding the grid and the resources connected to it.

Even as utilities understand the grid better, fewer grid resources will be under their direct control. Market signals will be needed to let utilities leverage resources at the distribution grid level. This means utilities will be creating markets in which these resources play. Whether it be real-time pricing, auctions for DER contributions to the grid, demand-response programs to leverage energy efficiency, or incentive periods for charging electric vehicles to smooth load profiles, utilities of the future will use data to send price signals to markets, thereby balancing the grid. Right now, the market is calling this the 'distribution system operator' model.

Of course, this is a dramatic departure from the existing utility business model. Moving from an electricity distributor to a distribution system operator model requires changes at the regulatory, utility and market level. It can't be done overnight. It begins with the inclusion of NWAs in utility planning, which works best when utilities can share the savings yielded from those projects. Utilities also must make major investments in advanced grid infrastructure to manage their new balancing act, achievable with PBR or clear rate-case signals from lawmakers and regulators. This work will make the final step of transitioning to a distribution system operator model manageable and possibly organic.

Technical changes surrounding grid modernization

Regulatory and business-model changes are key factors to transition to the grid of the future. For the grid to perform new functions and accommodate new forms of generation, it will require updating. Renewable generation reduces the carbon footprint of the grid, requires no fuel, and doesn't contribute to air and water pollution. However, the intermittency of wind and solar means the grid will need additional technology to use renewables effectively as primary generation. Capabilities, including energy storage, more advanced monitoring and control, enhanced distributed automation and system protection, will be needed for utilities to take full advantage of opportunities from DER services.

Further improvements in electricity distribution reliability will be a key enabler for such developments as the requirements on the distribution grid grow. Even a momentary interruption of five seconds will knock generation offline. Different generation types have different recovery times; some recover quickly while others within a few minutes. Others still can be subject to complex startup sequences, staying offline for longer periods despite service being restored to the feeder. During a large storm, with many scattered outages, this would be bad news for distribution systems that rely on these resources to manage the grid.

This goes beyond needing a change in utility business models; this path focuses on bringing the grid up to speed in all aspects of growth. The grid was designed more than 100 years ago, and many parts remain unchanged. For the grid to evolve as energy consumption has evolved, the addition of communicating devices, smart devices and greater control technologies must be present.

Conclusion

We have explored three paths to realize the full value of renewable generation and DERs. While each path can be effective on its own, the utility industry must pursue all three paths together. Some paths may take longer to navigate than others, but a fundamental rethinking of the rules of the game is necessary to transition to the grid of the future. Working together, regulatory bodies and utilities can enact real change that will not only help grid performance but ultimately benefit energy users worldwide.