How utilities can detect and predict Level 2 EV charger activity to improve capacity planning and grid impacts

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EVs are on the rise and, with them, Level 2 chargers. And while individual EVs have a minimal impact on the grid, higher concentrations and an increase of Level 2 chargers can stress the distribution system.

EVs are here: Harnessing analytics to turbocharge electrification planning and EV detection

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The clustering and hotspots of EV adoption mean that certain areas will experience significant load shifts, which is crucial for utilities to consider for distribution planning, customer engagement, programs offered (for example, time-of-use charging), accurate forecasting, and the integration of behind-the-meter resources to support the distribution system.

This uneven distribution of EVs will present challenges (and opportunities) for utilities in capacity planning and managing the evolving energy landscape. A data-driven approach can help.

Level 2 EV charger detection for the win

For those wondering what the fuss is about, think of it this way: A standard 110-volt outlet can provide a modest gain of about 5 miles of range per hour. But the Level 2 chargers—operating at 240 volts—are game-changers, capable of adding an impressive 20 to 30 miles of range every hour.

This surge in charging efficiency undoubtedly makes EV owners happy, but, simultaneously, it *will* affect the grid, especially knowing that Level 2 chargers are still common for fleet charging, particularly for overnight charging. Luckily, utilities now have the ability to forecast these surges so they can plan proactively.

Imagine a scenario where a substantial cluster of Level 2 chargers is located downstream of assets that already operate at their capacity limits. In such a situation, the celebratory mood of EV owners might be offset by a less glamorous consequence: an elevated risk of power reliability issues.

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According to research presented by SMUD and the Electric Power Research Institute at the 2023 Peak Load Management Alliance EV Symposium, EV: Data-Based Transformer Replacement Sizing for EV Adoption, transformers have traditionally (that is, without considerations for Level 2 charging) been sized with an assumption of about 5 kilowatts (kW) of peak load contribution per customer under a transformer. With each Level 2 charger load ranging from 10 to 20 kW, it's easy to see how just one to three EVs on Level 2 chargers during peak hours can overload a transformer above its kilovolt-ampere (kVA) rating, with a failure and customer outage a likely outcome. Proactively replacing 15-to-50-kVA transformers with higher-rated kVA transformers across a utility's system would save tens of millions of dollars under an assumed 25% EV penetration by 2030.

Thanks to advanced data science innovations, combined with advanced metering infrastructure data, a solution emerges. These models adeptly identify customers whose usage patterns align with using an Level 2 charger. The insights gleaned from this data are then seamlessly integrated into distribution asset risk models, with a more surgical replacement strategy considering actual as opposed to just assumed loading underneath individual transformers. This strategic integration serves as a proactive measure, offering significant savings from a solution to this emerging challenge, coupled with promotion of EV rates incentivizing off-peak charging.

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This innovative proposition benefits not only the utility but also the customer. By accurately detecting Level 2 charging at customer sites and proactively mitigating their risk to the distribution system, utilities can better manage the flow of electricity during peak demand times, harmonizing the load on the grid and minimizing the risks of overloading. Simultaneously, customers enjoy the advantage of cost savings, as the tailored rate structure incentivizes off-peak charging behavior, resulting in reduced electricity bills.

Predict now to avoid problems later

While some utilities may think they have ample capacity to handle the evolving challenges around EVs, this may not be the case in the future. A true comprehensive understanding of current EV ownership and fleet operations—particularly concerning Level 2 chargers used for fleet charging—is essential for anticipating the phasing of transportation electrification and its affect on the grid.

Using data science to identify Level 2 charger locations and predict where new Level 2 chargers will be added in the future is a smart (and critical) way to improve capacity planning and maintain reliability.

The power of data science and its risk models certainly paves the way for a harmonious solution that prioritizes both power reliability and customer satisfaction. As the EV revolution charges forward, innovative strategies like these will be instrumental in shaping a future where sustainable transportation and a resilient power grid coexist seamlessly.

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