ORACLE

Are you planning for customer participation in your sustainable DERMS ecosystem?

Electric vehicles' growing impact on distribution grids have the potential for turning huge challenges into opportunities.

January 2023

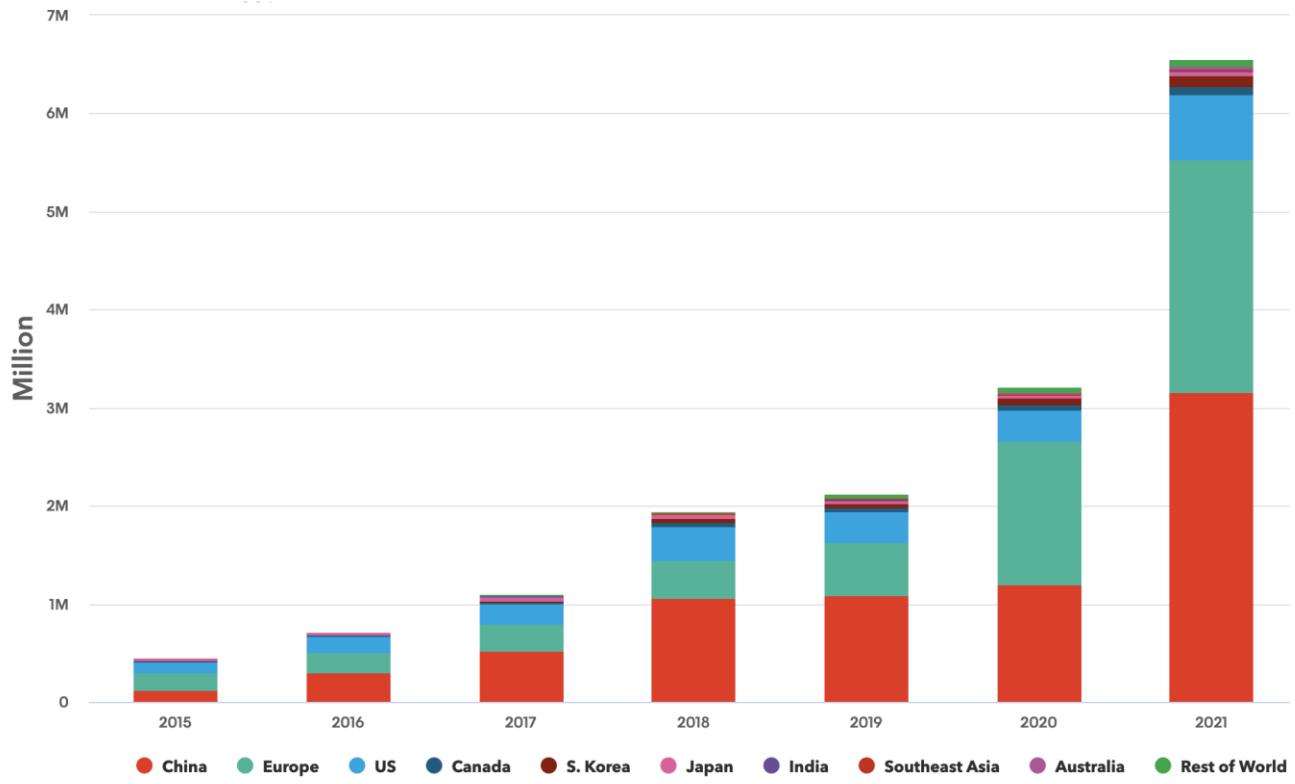
Public

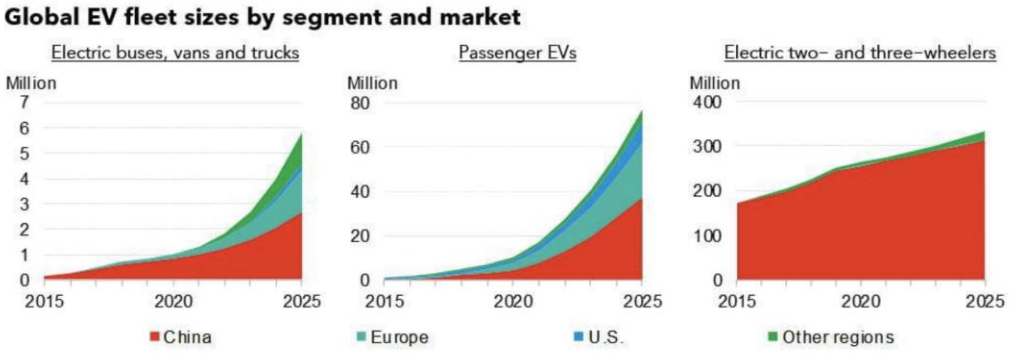
Utilities are continuously going through sweeping changes and facing new challenges as the industry evolves. Historically, utility operators would forecast demand and dispatch supply. Now the roles are reversing. As households continue to adopt dynamic rates, electric vehicles (EVs), solar, and battery storage, and even make small changes like smart home devices, they have the potential to be valuable partners to utilities in managing a cleaner, more flexible, and more resilient grid. Customers are becoming (and need to become) active grid participants; network operators can dispatch customers' distributed load and generation resources right alongside traditional generation to instantaneously balance supply and demand on the network; and this represents a major shift in the way utilities have operated as well as a lot of untapped potential.

Utilities know they must manage all this sweeping change while keeping power safe, affordable, and reliable for customers. By way of example, let's look at EVs and how they can and will impact distribution grids. Once considered the vehicles of the affluent, eco-friendly, or technology adopters, a recent *New York Times* article notes EVs are now becoming popular with car buyers who want to save money. According to recent industry data, Battery-powered cars now make up the fastest-growing segment of the auto market, with sales jumping 70 percent in the first nine months of the year from the same period in 2021. What does this growth in EV sales mean for grid operators as owners drive their new cars home and plug them in to charge?

According to BloombergNEF[i], the US faces one of the most difficult challenges, requiring a six-fold increase in average annual public charging installations over the next four years from those in 2021. Globally, the 2050 Net Zero scenario of electrifying all transportation will cause a 27 percent increase in electricity demand. The following graph summarizes global passenger EV sales by market, and the global EV fleet size by segment.[ii]

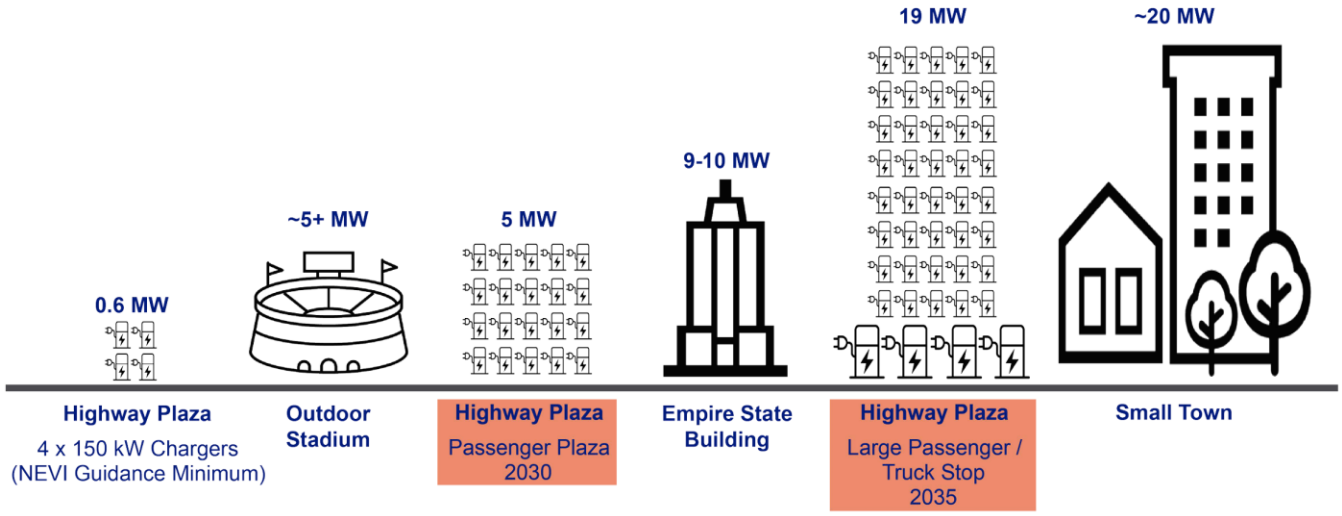
Global passenger EV sales by market





Source: BNEF. Note: Two-wheelers includes mopeds, scooters and motorcycles, excludes e-bikes.

The problem may not be the total amount of energy, but instead managing instantaneous demand, location of the demand, safety, and reliability. A recent study[iii] from National Grid, CALSTART, and RMI demonstrates this with the following diagram that illustrates how a mixed-use traffic plaza (or small logistics fleet) in 2030 will require 5 MW of charging capacity. This is about the same amount of power used by an outdoor professional sports stadium.



Source: "Electric Highways: Accelerating and Optimizing Fast-Charging Deployment for Carbon-Free Transportation" White Paper. https://calstart.org/wp-content/uploads/2018/10/Electric-Truck-and-Bus-GridIntegration_-Opportunities-Challenges-and-Recommendations.pdf

Now imagine this scenario shifting to residential areas. As more folks buy EVs for their daily transportation needs, drive them home, and plug them into their homes to charge overnight, what impact does this have on their neighborhoods? The average distribution grid was not designed to essentially more than double the peak demand of every home (with a Level 2 EV charger), and it is estimated that, in absence of additional planning and resources, as few as three new EVs charging in a neighborhood served off the same service transformer could overload it. This challenge is especially timely considering American Public Power Association president and CEO Joy Ditto's recent comment to *The Hill*: "When we at the American Public Power Association (APPA), serving not-for-profit publicly owned utilities, surveyed our members at the beginning of 2022, transformer delivery times averaged one year, compared to three months in 2018 (before the pandemic). Now, our membership is reporting wait times as high as 18 months to two years, with some manufacturers canceling orders because they don't have enough available stock to fill them." The APPA further forecasts demand for transformers increasing 9.1 percent and lead times for procurement rose 429 percent.

This scenario paints the picture of expensive, capital-intensive distribution grid enhancements of hardware (that may or may not be available) to address reliability in the environment of expanding customer demands. It would also mean that all ratepayers, even the ones in areas least likely to be in the next wave of adopters or have cars, would have to support the costs. However, there are more cost-effective alternatives that improve both reliability and customer service. When distribution grid operators can affect multiple points of their value chain, like incentivizing customers where and when to charge their EVs, they have the potential of turning a huge organizational challenge into an opportunity. In order for this to happen, customers must be the key partners to DERMS success.

What would happen in the above neighborhood as new EV owners plug their cars in at home to charge and their utilities pro-actively engaged with them to offer special incentives as to where, when, and how to charge their vehicles? Can utilities partner with their customers to turn EVs into more of the controllable energy storage assets they are capable of? This would help pave the energy transition. The current consumer EV fleet on the road in the US is an estimated combined 25,000 MW of potential Level 2 Charger coincident peak demand capacity, if they were all charging at the same time. Planning engineers understand there will always be some diversity as to when vehicles are charging at any given instant, but the point is we are not managing to its fullest potential.

Currently, there are some interesting programs to solve these challenges. Time of use rates (TOU) encourage EV owners to charge during non-peak hours. Offering Level 2 chargers with smart charging contracts gives utilities visibility of the EV and the ability to manage charging schedules and perhaps including a standard of performance to provide a specified EV battery state-of-charge by the next day's commute to work. Customer engagement enables behavioral load shaping in ways that customers desire to participate in order to create a more sustainable energy future for everyone. Similarly, several municipal and logistics fleet EV charging is being supplemented with their own local solar resources to help offset grid constraints.

Take proactive steps now

No change is easy, especially when it constitutes a seismic industry shift, but planning for it now will ease the transition, avoid downtime, and improve reliability. Look to a distributed energy resource management system (DERMS) that can aggregate DER and EVs for better grid balancing. By aggregating multiple distributed energy resources (including EVs), the DERMS platform can more effectively coordinate distributed EV charging load, and other DERs like solar production, on a more granular level, better balancing production and demand on both a day-ahead schedule and real-time basis. Using a DERMS platform to access the EV charging network operators in its service area, a utility could integrate with multiple EV charging network operators, forecast EV charging load, coordinate EV charging settings through algorithms in conjunction with the utility's distribution management system (DMS) requirements, and provide ongoing operating information to the DMS.

Anticipate and forecast EV growth in your territory. It's imperative that the utility act proactively, i.e., before EV growth begins to impact grid operations. Once you have that forecast and its attributes— like how fast it will grow, what neighborhoods you can expect to have a greater number of earlier adopters, etc.— it's time to engage with your customers in conversation before they make their purchase. Initiate the pre-emptive conversation about the things to be thinking about.

Engage and connect with your customers. It all begins with your connection to your EV owners. Do they report their EV purchase to you, just expect you to know they have one, or even care? If it's the latter two, it's imperative to identify the presence of EVs by exploiting machine learning, which will identify the EV's presence, show the time and frequency of charging, and disaggregate the energy being consumed by the vehicle from other energy being consumed by the customer (HVAC, pool pumps, etc.).

After identifying EV charging across the network, utilities can confirm with EV owners through normal channels, like email Home Energy Reports (HERs), and offer up valuable, real-time updates with EV charging in mind. HERs can also provide a vehicle for EV education and notification of any associated services the utility can provide.

From these machine learning detection analytics and customer confirmation, digital twin models of each detected device can be automatically created and populated into the customer-connected, beyond-the-meter DER device models in ADMS and DERMS, so grid operators and field crews have full situational awareness, optimization, and control.

Finally, offer a seamless journey between technical (DERMS) and behavioral (demand response) value, creating a single value chain by encouraging your customers to automate the management of their EV charging as part of a demand response process. For utilities, the approach for EVs must be done holistically, treating the EV value chain as a single entity. In this, it is imperative that grid operations, customer operations teams, and customers work in a synergistic fashion to optimize the potential EV value to the grid.

Unmanaged EV charging loads during peak periods are poised to significantly increase their power supply and infrastructure costs, limit awareness of upline grid impacts, and cause utilities to overspend on overly conservative upgrades for equipment. In a time when we are all trying to do more with less, DERMS addresses these concerns as well as safety and affordability.

[i] BloombergNEF Electric Vehicle Outlook 2022, https://about.bnef.com/electric-vehicle-outlook/

[ii] BloombergNEF Electric Vehicle Outlook 2022, Executive Summary, https://about.bnef.com/electric-vehicle-outlook/, https://bnef.turtl.co/story/evo-2022/?teaser=yes

[iii] "Electric Highways: Accelerating and Optimizing Fast-charging Deployment for Carbon-Free Transportation" White Paper, November 2022, https://calstart.org/wp-content/uploads/2022/11/Electric-Highways-Study-November-2022.pdf