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How electric utilities are feeling growing pains from advances in EV technology

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Here are the key findings from the EV Growing Pains study on 3,900 EVs.

Rising rates of electric vehicle (EV) adoption across North America, combined with advances in EV batteries and charging technology, will impact electric utility distribution infrastructure at a higher rate than previously projected. New electric vehicles differ greatly from older models, with drastic improvements over the last five years.

To highlight these signi cant changes, Geotab Energy conducted a study titled “Electric Vehicle Growing Pains,” that analyzed charging and driving data. In the data analysis, we created two segments: one representing what would have been on the road in 2014 and what is currently on the road now.

The data from almost 4,000 electric vehicles sends a clear message: long-range BEVs are a game-changer for electric utilities.

Long-range BEVs have redefined the EV ecosystem

As the fastest-growing vehicle type, long-range battery electric vehicles (BEVs) continue to represent a larger proportion of new EV sales. The long-range BEV has increased in proportion of new electric vehicle sales from 14% in 2014 to 66% in 2019 in the United States.

In fact, 4 of 5 today’s top-selling EVs were not in production in 2014. The Tesla Model 3 , which came into production in 2017, accounted for 47% of all new U.S. electric vehicle sales in 2019. Any previous studies, which did not include these vehicles, no longer provide an accurate representation of the impact of today’s EVs.

Today's EVs are very different from older models

The single biggest finding in the data study was that long-range BEVs — which are defined as fully electric vehicles with a battery capacity of 50 kWh or greater— are significantly different from other types of EVs. Since they are driven more, and have a larger battery, it is no surprise that they consume twice as much energy.

When comparing the average amount of energy drawn per charge event the 2019 vehicle group was almost exactly double.

What utilities may find surprising is that they aren't charging over a longer period, the average time spent charging for both vehicle groups was between 3 and 3.5 hours. However, when they are charging they are using twice as much power.

Increasing power usage, combined with the fact that the charging behavior of these EVs is harder to predict, means that utilities are going to have a tougher time integrating these vehicles into their load management programs.

The increasing impact to the grid at the street level

The biggest risk posed by EVs is at the distribution level of the grid. EV clustering is a trend that shows that EVs may not be distributed evenly across the utility service territory, with the high likelihood of EV owner concentration on a specific street or neighborhood.
To simulate this, five vehicles from each vehicle type were selected at random and their load was combined for a randomly selected day. This would represent the vehicles being charged on the same residential transformer.

The results clearly show that long-range BEVs have significantly higher power draws as this group had an average max power peak of 7.34 kW.

It’s not just the vehicles that have changed

Electric vehicle charging technology has evolved to accommodate the needs of newer long-range electric vehicles.

There are two types of charging stations used by EV owners at home:

Level 1 charging — utilizes a standard 110/120 V plug which can provide u p of charging power, or approximately 4.5 miles of range per hour. This level is decreasing in popularity simply because it takes too long to fully charge a newer vehicle that has a larger battery.

Level 2 charging — utilizes a 208-240 V plug and can provide between 2.5 and 19.2 kW of charging power and over 40 miles of range per hour, making them the preferred home charging station.

Not only are Level 2 charging stations becoming more popular, they are also becoming more powerful. In 2014, the most sold EV in the U.S. was the Nissan Leaf, which has a maximum charging capability of 6.6 kW. By comparison, the most sold EV in 2019 was the Tesla Model 3, which has a maximum charging capability of 11.5 kW.

A lot has changed in 5 years, but the next changes will be even greater

Ultimately, the increased battery capacity in newer vehicles has driven all these changes. They made electric vehicles more appealing, increasing overall adoption, and they have a larger impact for utilities.

However, this evolution is just the beginning. The popularity of long-range BEVshave driven down prices, meaning adoption will continue to grow, and there are new vehicles that are entering the market.

One example of the next wave of changes is the introduction of light-duty trucks. The Rivian R1T electric truck that boasts a battery capacity of 180 kWh, which is almost twice the size of any current vehicle in the market.

As the market continues to evolve it will be critical that utilities gather up-to-date data so they can properly manage this increasing load.

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