ELECTRIC VEHICLE CHARGING NEEDS A 'GOLDILOCKS SOLUTION'

By Lauren Jessop,
The Center Square Contributor

While it is less expensive to charge your electric vehicle at home, using a public station will become inevitable. It's a reality that concerns owners and deters others from making the switch.

The solution, however, will involve hitting a precise target of stations, charging technology and economic impacts, experts say. A reliable charging infrastructure is an important piece of a complex puzzle. As the number of charging station installations increases, so do the challenges involving their operation and maintenance.

Despite pathways being created by government and industry stakeholders to bolster the charging infrastructure, a combination of factors — including price, reliability, lifestyle changes, and range — have led to underwhelming EV sales.

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Robert Charette, a longtime systems engineer, contributing editor for IEEE Spectrum, and author of "The EV Transition Explained," told The Center Square, that isolating any of the components cannot be done as they are all interconnected like a spider web.

"Everything you do touches something else," he said.

A large issue, he said, is the electrical infrastructure — generation, transmission and distribution — and its intersection with business, residential, apartments and rural communities. Other concerns include reliability, profitability, software security and cable theft.

Charette says charging infrastructure terminology can be confusing. To clarify, a charging station is a location with one or more charging posts installed. A charging post may have one or more ports, and each port can charge a single vehicle.

Equipment and power levels at charging stations vary. There are three types of chargers operating under different charging speeds:

Level 1 chargers plug directly into residential 120-volt outlets, providing approximately three to five miles of range per charging hour. An empty EV battery could take 40 to 50 hours to fully charge.

Level 2 chargers — the most widely used for public charging stations currently — can be installed at home using 240-volt outlets, similar to those used for home appliances like washing machines. They offer 18 to 28 miles of range per charging hour, requiring four to 10 hours to charge an empty EV battery.

Level 3, or DC fast chargers, are the most powerful and can charge an EV battery to 80 percent in 20 minutes to 40 minutes, and to 100 percent in 60 minutes to 90 minutes. First-generation EVs and plug-in hybrids cannot use these chargers.

Plugs on charging ports vary, so compatibility depends on the vehicle's connector. Level 1 and 2 charging units use a J1772 connector, or J-plug, and DC fast chargers use CCS, CHAdeMO, or a Tesla connector, now called the North American Charging Standard, or NACS.

Tesla connectors are proprietary, but non-Tesla owners can purchase an adapter. However, with Tesla opening its connector design to network operators and vehicle manufacturers, it could become the industry standard.

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To date, at least 18 auto companies have decided to add Tesla-compatible plugs in their new EVs by 2025.

According to the U.S. Joint Office of Energy and Transportation, there are currently 56,127 L2 charging locations with 127,908 ports across the U.S., and 9,026 DC fast charging stations with 37,316 ports, of which 60% are Teslas.

Pennsylvania has 1,508 L2 charging locations with 3,244 ports and 231 DC fast charging locations with 967 ports.

Predicting future charging station needs is challenging, but Charette says experts agree we will need approximately 20 times today's infrastructure.

"This means installing hundreds of charging ports every day for the next decade, at least," he said. He says hitting a "Goldilocks" number of EV charging stations will be important.

Too many, too soon, and stations will not be maintained or upgraded, or shut down, for lack of profitability. Too few, and consumer frustration will grow, risking slowing the EV adoption. He said "a wild card" would be economically feasible EV battery-range breakthroughs, which could end up dampening the demand for public charging stations.

"Until the EV charging equation is solved, transitioning to EVs will be slower than the administration and EV advocates desire," Charette said.