WiTricity®
Powering life, wirelessly.

Leave the Filling Station Behind:

Wireless, distributed, 7-11 kW charging changes how, when and where EVs will "fill up" — and makes charging easy as parking a car

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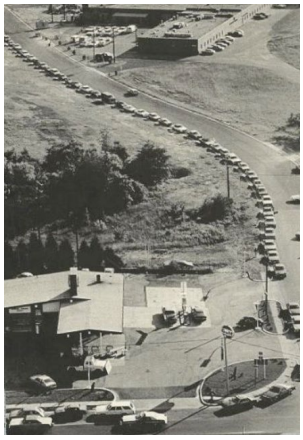

Gas lines, 1973

In 1973 and again in 1979, cars lined up sometimes for blocks on end at filling stations — with gas rationing and consumer panic replacing the laws of supply and demand. Electric vehicle (EV) owners today, by contrast, don't face shortages or supply crises over their fuel. Electricity is of course not nearly as volatile a commodity as oil.

Yet, relying too heavily on the "filling station" mindset risks the downsides of filling stations too. Level 3, DC Fast Charging (DCFC) kiosks at gas stations, rest areas and shopping centers will undoubtedly be crucial EV range extenders. However, according to studies by the National Renewable Energy Laboratory, DCFC will only be needed 4% of the time, when EVs are used for longer trips that extend beyond their battery capacity. [1]

For the vast majority of EV use — the other 96% of the time — DCFC will be overkill and likely anywhere from an inconvenience to a hassle to the kind of miserable, queuing experience drivers regularly faced in 1973 and '79. This time, though, rather than a shortage of fuel, a shortage of DCFC stations would be the cause of any lines at the "pump."

EVs can in fact leave the filling station experience nearly completely behind — at least 96% in the rearview mirror.

The future is distributed charging

One of the great benefits of EVs is that there is no need to travel to a filling station or other shared, public DCFC charger. Because cars are parked 95% of the time [2], there is ample EV down time to charge to capacity at one's home or workplace using a 7-11 kW Level 2 charger — which typically refills from empty in 3-4 hours.

EV production is also ramping up today, which will greatly increase the pressure to deploy more public DCFC charging stations.

According to McKinsey & Company, by 2025, consumers will have more than 350 feature-rich EV models to choose from. [3] The McKinsey research concludes the EV boom could lead to a corresponding bottleneck: "If consumers purchase EVs at the expected rates in the next five to ten years, a lack of charging infrastructure could become an obstacle to EV adoption." [4]

This prediction is especially relevant considering DCFC's considerable price tag. According to two independent studies by the National Renewable Energy Laboratory (NREL) and Ceres/M.J. Bradley & Associates, the average cost to install a DC Fast Charging station will be between $40,000 and $55,000. [5] However, even the fastest Fast Charging stations (350 kW) are still ten times slower than a gas pump. Because gasoline is so energy dense, filling with a gas pump is the equivalent of charging at over 3 *megawatts* charge rate.

So even the most ardent DCFC enthusiast would spend some 30 minutes charging up versus 3 minutes to fill up their gasoline-fueled car. Imagine the lines at DCFC "gas stations" when every car is sitting at the pump for a half an hour just to fill up.

This, simply put, is why DCFC is not a practical or realistic solution for a vast majority of EV drivers in a vast majority of (non-long distance, non-range extending) uses. Add to that the lower price tag compared to DCFC (Average $3000 cost for Level 2 charging compared to $40,000-$55,000 for DCFC [6]). Utility company upgrade fees and monthly "demand charges" can add hundreds of thousands of dollars cost to the installation and operation of a DCFC station.

This is why Level 2 charging, on balance, represents the optimal compromise between charging speed on one hand and affordability/accessibility on the other.

The future is *wireless*, distributed charging

Consider when WiFi internet access was still being rolled out. When both WiFi and hardwire Ethernet access were available, how often did users opt for the physical cable? In other words, given the choice, what laptop, tablet or smartphone user would prefer to forego WiFi so they could instead physically plug their device in to an Ethernet jack?

Park-and-Charge – no mess, no hassle – even in poor weather.

A similar self-evident question might one day be asked about how EVs fill up their batteries.

Wireless Level 2 charging as compared to corded Level 2 chargers offers a simple, clean, reliable and robust method of charging. Corded Level 2 chargers are clumsy, dirty, and inherently more failure prone due to the complex connector and large number of insertions it must handle. Wireless Level 2 charging is also a better solution for poor weather conditions such as rain and snow. After all, who wants to plug in a high voltage cable when standing out in a parking lot in the rain?

Level 2 wireless charging at home – happens overnight.

Moreover, no standards exist for corded EV charger plugs. When you buy an EV, you simply cannot know if your model will be compatible with the majority of corded chargers available to your EV in the future, especially as the marketplace is still very much in flux today. By contrast, OEMs are collaborating on a common standard for wireless charging.

As with the ultimate dominance of WiFi internet over corded, multiple factors are converging to determine who will dominate the EV charging space tomorrow. **Given wireless's convenience, simplicity and speed (WiTricity wireless EV charging boasts identical charge times as corded), wireless Level 2, it is safe to project, will play an increasingly substantial role in the market as it develops and matures.**

WiTricity, using a wireless charging technology called Highly Resonant Wireless Power Transfer, offers a high efficiency 3.6 - 11 kW EV charging system called DRIVE. According to independent, U.S. Department of Energy testing, WiTricity DRIVE is the most efficient and interoperable wireless charging system available today.

WiTricity DRIVE, based on the widely accepted circular coil architecture preferred by carmakers worldwide, delivers:

- Scalable charging rates of from 3.6 to 11 kW, to meet the needs of vehicles ranging from PHEV's with small capacity battery packs to EV's with high capacity, long range battery packs.
- The ability to charge vehicles ranging from low ground clearance sports cars to medium ground clearance sedans to high ground clearance SUV's, with a single system charger design.
- The ability to be installed as an on-ground charging pad in a private residence or buried in the pavement of a parking lot as public charging infrastructure.

EV consumers and OEMs, attuned to marketplace trends, will increasingly turn toward new Wireless Level 2 charging solutions to break free of the "filing station" mindset and make charging as simple as parking your car.

Visit WiTricity's website (www.witricity.com) today to discover the world's most efficient wireless EV charging solution and the future of EV Level 2 charging into the 2020s and beyond.

Endnotes

[1] Ceres and M.J. Bradley & Associates Industry report drawn from a national analysis conducted by the National Renewable Energy Laboratory (NREL)

[2] David Z. Morris, "Today's Cars Are Parked 95% of the Time." Fortune (March 13, 2016) citing work by transportation researcher Paul Barter/Reinventing Parking ("'Cars are parked 95% of the time.' Let's check!" ReinventingParking.org (Feb. 22, 2013))

[3] Hauke Engel et al, "Charging ahead: Electric-vehicle infrastructure demand." McKinsey & Company (Aug. 2018)

[4] *ibid*.

[5] Ceres/M.J. Bradley & Associates LLC, "Accelerating Investment in Electric Vehicle Charging Infrastructure" report (Mar. 2018) p. 24; Eric Wood et al, "Analysis of Fast Charging Station Network for Electrified Ride-Hailing Services" SAE Technical Paper 2018-01-0667, 2018, doi:10.4271/2018-01-0667.

[6] "The DOE estimates that the installation costs for public Level 2 chargers vary from $600 to $12,700 with an average of $3,000 per port." *ibid*.

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