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Don't Let a Lifetime of Gas Station Experiences Steer Your EV Charging Infrastructure Decisions

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I opened a recent meeting with a group of investors in New York by asking if any of them had ever driven an electric vehicle (EV). Of the fourteen or fifteen in the room about half raised their hands. I've been asking that question for many years now and have happily observed this micro indicator of the macro trends in EV adoption – from zero then, to half the people in the room now. Before I could move on to my next point one of the investors volunteered "once you own an EV you'll never go back." If you've dealt with the investment community you'll know that there is nothing better than having your audience steel your pitch lines before you have offered them. But beyond my gratitude for his unwitting support I was struck by how true his comment is. No one (that I know of) who owns an EV would consider, for one second, returning to a car with an internal combustion engine (ICE). It would be like giving up your mobile in favor of a cord attached to the wall or putting a typewriter back on your desk. Not a chance.

There are so many aspects of EV ownership that are indisputably better than the ICE experience that it would be sheer folly to try to include them all in one essay but there is one in particular that has significant ramifications on infrastructure decisions. Understanding this difference is key to making the right choices in the deployment of EV chargers.

For over a century we have been trained to view fueling our vehicles as an event that takes place at a destination. There are specific locations dotted about the country where all motorists go to fill their cars with fuel. It's always a special trip because, though gas stations have tried to bolster the low margin part of their business which is core with higher margin non-core lines like retail, maintenance, coffee and carwashes, it's still a fact that no-one would chose to go to a gas station absent the gas. We've become so used to this model that most ICE drivers don't even view it as an inconvenience, even though they might spend several weeks of their lives and drive thousands of extra miles making special trips to fill up their cars. It is possible, I suppose, that some people enjoy going to the gas station, and grasping what has been described as the most germ ridden device that any of us ever touches before using it to fill a steel box, under their children's seats, full of carcinogenic and highly volatile liquid, but I don't know anyone who does.

Electric vehicles offer a way out of this cycle of wasted time and miles. They signal the end of destination fueling and usher in a new era of filling up where you were already going rather than going somewhere you weren't going just to fill up.

After you have owned an EV for a while you get so used to this idea of fueling your car in locations you chose to visit on the merit of the visit, not the fill up, that you become indignant and frustrated any time you are unfortunate enough to have no choice but to drive an ICE. In my case this only happens when I have to rent a car during a business trip. I'm forced back into the medieval practice of visiting gas stations, places which I'd rather forget about forever. It's one of the key reasons that EV owners make statements like my investor friend above. You never want to return to the rotten old ways once you've seen that there is a far better new way of doing things.

It's very important to consider this change in fueling behavior when thinking about what sort of EV charging system you should install. Paradoxically, but not surprisingly, many champions in the EV charging and auto manufacturing industries, and also within the various agencies charged with promoting infrastructure, are trying very hard to replicate the old gas station experience by advocating for rapid and expensive EV charging solutions. Though they are all advocating for the same thing it's likely that they are doing so for different reasons. EV charging companies make more money and exert more control over the utility grid with fast charging solutions than they do with slower more reasonable approaches. Automobile manufacturers

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believe that the surest way to get a new technology adopted is to make it look so much like the old one that it doesn't scare consumers. Nine out of ten decision makers in agencies charged with promoting EV charging infrastructure and the same proportion of private sector employees tasked with installing it, don't own EVs and so, predictably, push for what they are used to – the gas station model - somewhere you can go and force fuel into your vehicle while you stand around twiddling your (now germ ridden) thumbs.

The best way to avoid falling into this perhaps comfortable but nevertheless unfortunate trap

is to consider some fundamental facts about typical automobile use and ignore, totally, whatever range an EV might offer – it's irrelevant. People don't drive range, they drive miles and the miles they drive are what you should be thinking about when offering them a refueling

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facility. First, recognize that most car owners leave their vehicles unused for 95% of the time. Parked at home, parked at work, parked at the mall, parked at the kid's never-ending sports events,parked, parked, parked. Second, note that according to the US Department of Transportation the average number of daily miles driven by Americans is 36.9. Third, know that eight out of ten commuters require less than 20 miles to get home after work. We think we use our cars a lot more than we actually do. All this parking combined with the low number of miles actually driven creates an excellent opportunity for your car to do something useful while you're off working to pay for it. It can fill up with electricity and it will do so without you being there. The eight hours spent at work, or sleeping, in every twenty-four are many more than are required to provide for most commutes and average daily driving at even the slowest of existing charging rates.

Plugging into a standard 120-volt wall outlet (Level 1 in the industry jargon) will put about five miles of range into your EV each hour. That might sound terrifyingly slow from the point of view of a gas station visit but why would you care? You aren't at a gas station; you are safely tucked up in your comfortable bed or hard at work at your desk while your EV is diligently recouping all the range that you need for your next drive. Level II, or 240-volt EV chargers, generally deliver around twenty-five miles of range each hour. If you're the typical commuter you'll get twice your homeward-bound trip in one hour of Level II charging or your total daily requirement of miles in less than two hours. Even if your commute is one hundred miles each day (in which case you have my deepest sympathies) you will find your EV ready for the task after only four hours on a standard (not fast) Level II charger.

Our mobile phones offer excellent proxies for this new fueling behavior. When was the last

time you pulled off the highway to find somewhere special to charge your phone. When have you ever gone somewhere special to do that? Do you wait till your mobile is completely empty before going somewhere to completely fill it up? I don't. I plug my phone in any time I see a little white wire. I top it off continuously. I charge at my desk, while eating lunch, when I'm sleeping and while I'm waiting for a flight at the airport. And that's exactly how I fill up my electric vehicle. It never takes me more than ten seconds to plug it in and then I'm off to do something I'd rather be doing. Topping off is the best way to keep your EV and you happy.
Why on earth would anyone choose to go to some dingy destination to fill up when their car will efficiently do it for them while they are happily engaged in doing something much more useful like working, sleeping, eating or spending time with the kids? And why on earth would anyone spend vast sums of money deploying very expensive and disruptive fast-charging infrastructure when more reasonable levels suffice in almost every case?

As it happens there are a couple of distinct cases where expensive and disruptive fast charging makes sense. In fact, it's an excellent and vital solution for these cases. On the rare longer trips that Americans take it is, of course, important to be able to get back on the road within a reasonable time after running low on fuel. Only the strangest of characters wants to spend several hours hanging around at a rest area (doing what only they will know and understand) the rest of us are impatient to fill up and be on our way. DC fast charging offers a means to that end. It's expensive and disruptive as I've stated but deployed judiciously it is an excellent investment in vital infrastructure. Some will also argue that because so many Americans (about 60%) don't have their own garages and thus

can't charge at home, DC fast charging stations at apartment buildings should be installed. That is a concept which seems to make sense until the obvious practical challenges are thought through. Forgetting, for the moment, the expense and difficulty of delivering the very large, new circuits that would be required, there is the question of how multiple residents would take advantage of one or two fast chargers. Yes, the vehicles will fill up very quickly and could be moved, but who will don their pajamas at three o'clock in the morning for a quick stroll down to the EV charger to unplug and make it available for an equally soporifically challenged neighbor? Apartment dwellers will be much better served by ubiquitous Level II charging at work and in the numerous locations they visit during the course of their busy lives. Beyond workplace charging and home charging, for those that are lucky enough to have it, The best solution for charging EVs is also what makes them so irresistible to those that have experienced them; they can fill up wherever their owners already spend time.

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This means that **municipal top-off** charging should be heavily emphasized along with work place charging. All Americans go to the store, all Americans go out for work and/or pleasure, all Americans eat out, all Americans go to the movies, all Americans go to the park or beach, all Americans play baseball. OK – perhaps there are few risky generalizations in the preceding list but the very fact of owning or using a vehicle suggests going somewhere and dwelling there for a period of time. In the future, all such

locations will be equipped with EV chargers just as all locations have WiFi today. In almost every case the range that needs to be replenished at each stop will be less than 25 miles, meaning that Level II chargers will more than suffice.

This will happen because the mighty American consumer will demand it and it will change all of our lives for the better. I have two hopes where this paradigm shift is concerned. the first is that the great majority of those locations are powered by locally and renewably generated and stored electricity. The second is that we don't allow the deeply rooted habits of the last century to cause us to waste precious money and time deploying a lot of fast-charging infrastructure because of our ICE trained fears about range anxiety. EVs aren't ICEs. Our children will think it very odd that we used to go somewhere special to fill up our cars instead of just letting them fill up wherever we were already going.

It generally costs at least 10 times as much to install a fast charger than one of the more approachable lower speed solutions. It takes a lot longer and the electricity it dispenses will almost certainly cost more and destabilize the grid more (good reasons to go renewable). That means ten times less EV charging locations for the money, much more disruption and effort and a higher operational cost. Those things all add up to impediments to infrastructure deployment.

That's not good for the planet, the economy or our geopolitical stability and it's not good for you if you paid for or managed the installation.

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