From Charging Infrastructure to Energy Orchestration

Why Home Charging Will Become the Backbone of Small Fleet Electrification

Fleet electrification is accelerating at a pace few predicted. Vehicles are no longer the constraint—battery costs are falling, range is improving, and regulatory pressure is mounting. Yet across industries, one issue continues to slow progress: not the vehicles themselves, but how they are charged.

For most fleet operators, the instinct has been to replicate what already works. Build centralized depots, install high-powered chargers, and route vehicles to energy. It's a familiar model, rooted in decades of fuel logistics. And at first glance, it seems logical.

But this approach is increasingly colliding with a fundamental reality: electricity does not behave like fuel.

Fuel is scarce, transported, and stored. Electricity is ubiquitous, time-sensitive, and governed by networks. When fleets attempt to centralize charging, they are not simply building infrastructure, they are concentrating demand in ways the grid was never designed to handle.

This distinction is more than theoretical. Research from the National Renewable Energy Laboratory (NREL) shows that the cost and complexity of electrification are driven not by total energy consumption, but by when and where that energy is drawn. In other words, the grid does not struggle to generate electricity, it struggles when too many vehicles charge in the same place at the same time.

Centralized depots, by design, create precisely this problem. They concentrate load into a single node, forcing utilities to upgrade infrastructure to handle peak demand. These upgrades are not trivial. Studies indicate that site-level grid improvements alone can range from $100,000 to $500,000 or more, with interconnection timelines stretching from six months to over two years in constrained regions.
(https://docs.nrel.gov/docs/fy20osti/75269.pdf)

The economics follow predictably. Installing a single DC fast charger can cost anywhere from $70,000 to over $200,000 once construction and permitting are included. When multiplied across a modest fleet, the numbers escalate quickly. A 20-vehicle deployment can easily require $1.7 million to $2.5

million in upfront investment before accounting for operational costs. (https://docs.nrel.gov/docs/fy23osti/85654.pdf)

And those operational costs are far from negligible. Demand charges and fees based on peak electricity usage can account for 30% to 70% of total energy costs for high-powered charging sites. Even underutilized depots can remain expensive simply because they must be sized for peak capacity. (https://docs.nrel.gov/docs/fy22osti/82738.pdf)

On a small scale, these challenges are manageable. At fleet scale, they become structural.

What makes this dynamic particularly striking is that, while fleets invest heavily in building new infrastructure, they often overlook a critical fact: the largest charging network already exists.

It is not owned by charging companies or utilities. It is not located along highways or in industrial parks. It is distributed across millions of homes.

Residential electricity infrastructure, already built, already connected, and largely underutilized represents a nationwide charging network hiding in plain sight. For fleets with take-home vehicles, this network is immediately accessible. It requires no land acquisition, no permitting, and in most cases, no significant grid upgrades.

And yet, it remains underused.

The reason is not technical, it is systemic. Home charging lacks the elements required for fleet-scale operations: visibility, control, and financial integration. Without these, it is difficult to manage, impossible to optimize, and burdensome for drivers.

But where the system is properly enabled, the advantages are difficult to ignore.

The cost differential alone is substantial. Installing a residential Level 2 charger typically costs between $1,000 and $3,000 per home, an order of magnitude lower than depot infrastructure on a per-vehicle basis. (https://theicct.org/publication/home-charging-infrastructure-costs-mar23/)

Energy costs follow a similar pattern. Residential electricity rates in the United States typically range from $0.12 to $0.20 per kWh, compared to $0.25 to $0.50 or more for commercial or demand-charged environments. (https://afdc.energy.gov/fuels/prices.html, https://www.eia.gov/electricity/monthly/update/end-use.php)

Taken together, these factors create an estimated ~5–10x cost advantage for home charging.

But the more important insight is not economic, it is behavioral.

Data from the U.S. Department of Energy and the International Energy Agency shows that the majority of EV charging already occurs at home or at work. Drivers consistently prefer overnight, passive charging over dedicated trips to charging locations.

(https://afdc.energy.gov/files/u/publication/electric_vehicle_charging_infrastructure_trends_third_q..., https://www.iea.org/reports/global-ev-outlook-2024)

More significantly, access to home charging is the single strongest predictor of infrastructure demand. Drivers with reliable home access rely far less on public or fast charging networks. In effect, home charging does not just reduce cost, it reshapes the entire infrastructure requirement.

This has implications far beyond individual fleets.

Managed residential charging, where charging is scheduled, optimized, and coordinated has been shown to reduce strain on the grid and avoid significant infrastructure investment. One joint study by the International Council on Clean Transportation and the Regulatory Assistance Project found that flexible charging could avoid $100 million to $300 million per year in grid upgrades in a single region.

At this point, the narrative begins to shift.

Home charging is often framed as a convenience feature or a cost-saving tactic. In reality, it represents something much more fundamental: a transition from infrastructure to orchestration.

In a centralized model, value is created by building and owning physical assets. In a distributed model, value is created by controlling how those assets are used.

This distinction is already familiar in other industries. Cloud computing replaced on-premise servers not by eliminating infrastructure, but by orchestrating it more efficiently. Payments evolved from physical terminals to embedded financial networks. Mobility shifted from ownership to platforms.

Charging is now undergoing the same transformation.

The emerging model is not defined by where chargers are located, but by how energy is coordinated across them. Instead of routing vehicles to energy, energy is managed wherever vehicles happen to be, primarily at home.

This shift gives rise to a new category: the Virtual Charging Network.

A Virtual Charging Network is not a physical system, but a software layer. It aggregates distributed charging endpoints at homes, workplaces, and public chargers and orchestrates them as a unified, controllable infrastructure. It enables fleets to detect charging sessions automatically, allocate costs in real time, enforce policies, and optimize energy usage without manual intervention.

In doing so, it transforms a fragmented set of charging locations into a coherent system.

The implications are significant. Deployment becomes nearly instantaneous, as new capacity is added simply by onboarding vehicles. Scalability becomes linear rather than step-function, eliminating the need for large, upfront capital investments. Risk becomes distributed rather than concentrated, improving resilience. And perhaps most importantly, the system becomes programmable.

This programmability introduces a new dimension of value.

Fleets are no longer just consumers of energy, they become participants in the energy system. Charging can be shifted to off-peak hours, aligned with renewable generation, or integrated into demand response programs. Over time, this transforms charging from a cost center into a controllable, optimizable resource.

The market opportunity reflects this shift.

Fleet energy consumption in the United States alone represents an $8 billion to $20 billion annual market, with global estimates reaching $50 billion to $100 billion or more.
(https://tedb.ornl.gov)

But the true opportunity extends beyond energy spend. By avoiding depot construction and reducing grid upgrades, distributed charging unlocks billions in avoided capital investment. It is not simply a cheaper way to charge vehicles, it is a fundamentally more efficient way to build the system.

This is why the conversation is evolving.

The question is no longer how many chargers need to be built. It is who will control the flow of energy, data, and payments across a distributed network.

Because in an electric system, infrastructure is abundant. What is scarce is coordination.

The companies that define this space will not be those that deploy the most hardware. They will be the ones that build the control layer, the platforms that make distributed charging reliable, seamless, and financially integrated.

In that context, home charging is not the endpoint. It is the foundation.

The real innovation lies in orchestration.

And the fleets that recognize this early will not just electrify faster, they will do so more efficiently, more flexibly, and at a fraction of the cost.

Depot charging is a bridge.
Home charging is the foundation for Light-Duty fleets.
Orchestration is the future.

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