2025 Annual Reliability Report

The State of EV Charging and the Driver Experience

PUBLISHED SEPT. 2025

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EXECUTIVE SUMMARY

By the end of 2024, the industry set another record in electric vehicle (EV) sales: one in 10 or 1.3 million vehicles sold in the United States was electric. With Americans expected to buy 1.6 million EVs this year, passenger sales are predicted to rise year-over-year (YoY), even as the U.S. faces federal cuts to EV funding, tariff uncertainties, and a shifting regulatory environment.

Consolidation in the EV industry also brought exits and new entrants. Several companies went under or closed their American operations, while European providers, backed by deeper capital and more mature business models, moved in. It’s a striking evolution, but whether their approaches translate to the U.S. or resolve America’s reliability challenges remains unclear.

The electric vehicle (EV) industry is navigating market turbulence by shifting its focus. Beyond initial sustainability goals, the industry is now prioritizing the practical aspects of electrification, including cost, reliability, and the daily experiences of both fleets and individual drivers.

The Open Charge Alliance’s (OCA’s) Open Charge Point Protocol (OCPP) 2.0.1 introduced several enhancements for improving charging performance. This international standard is crucial for protecting consumers, capital investments, and the EV charging infrastructure (EVSE) that are essential for the industry's viability and sustainability.

Moreover, in an effort to tackle data silos, technical complexity, and EVSE charging needs, leaders in auto manufacturing, transportation, government, and other sectors are pooling their talent and resources to streamline supply chains and expand charging capabilities for EV drivers everywhere.

Outside the United States, the acceleration of EV adoption continues to inspire. In Norway, where 97% of new car sales are electric, we see what a mature EV market looks like: one defined by consumer trust, a sustainable business model, and broad consumer choice for drivers.

Steady market growth and EV adoption domestically and globally prove that reliability has become impossible to ignore, especially as gas-powered vehicles are still viewed, on average, to be more dependable than EVs. While early adopters have touted the benefits of electrification, the reliability of EVSE now sits at the center of public perception, as drivers continue to experience issues with the availability and usability of chargers.

True EV charging reliability cannot be measured by industry players or capital alone. Instead, to develop a widely adopted framework for understanding the EV driver experience, reliability must rest on a foundation of trust. Laying this groundwork will require clear communication, precise measurements, and tangible results. By implementing more exact, user-focused key performance indicators (KPIs), the industry can move toward a shared language of reliability that reflects the realities drivers face.

This year's report examines the gap between reported uptime and the ChargeX Consortium's charge start success KPI, introducing the latter as a sharper, more accurate lens into reliability performance. While a network can report high uptime, it doesn't equal reliability if a driver's session fails to start.

Earning and retaining EV drivers' trust while delivering an excellent charging experience is a collective responsibility involving all EV stakeholders, from station operators to policymakers to manufacturers. By pursuing a broader set of industry actions—building driver trust, improving data transparency, investing for the long term, and ensuring accountability—we can chart a course toward a more mature, seamless, and reliable EV charging ecosystem.

– Kameale C. Terry
CEO, ChargerHelp

DATA SOURCES AND DISCUSSION

We leveraged six primary data sources for this 2025 report to understand the current state of EVSE reliability in the United States. Our analysis focused on public Level 2 and DC fast charging infrastructure in 2025, with historical context extending back to 2024, where available.

6 DATA SOURCES ANALYZED

The State of EV Charging and the Driver Experience

SCOPE OF ANALYSIS

- **Public Level 2**
- **DC Fast Charging**
- **U.S. Nationwide Coverage**

Primary Data Sources

ChargerHelp OCPP Data Analysis

Our most comprehensive dataset came from direct OCPP telemetry feeds from 2,700+ charging stations operating under ChargerHelp's Reliability as a Service program in 2025. Through September 2025, we've captured over 100 million OCPP messages representing approximately 300,000 charging sessions—providing unprecedented visibility into real-time station performance, error codes, and the correlation between reported availability and actual charge start success. Uniquely, this data aggregates across multiple Charge Point Management Systems (CPMS) and Charge Point Operators (CPO), offering a unified perspective that transcends individual network limitations.

100M+
OCPP Messages (by Sept 2025)

18 Months of Connector-Level Reliability Data

300,000 Sessions Captured

Jan 2024 – June 2025

2,700+
Charging Stations in the Dataset

16 Networks

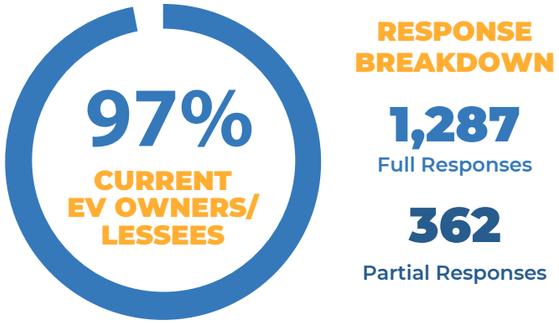
Paren Network Monitoring Data

Paren, Inc. provided comprehensive weekly performance data across 16 anonymized charging networks from January 2024 through June 2025, tracking connector-level reliability metrics. The dataset captures whether individual connectors were down for 90% or more each week, providing granular visibility into network performance trends. With data spanning 18 months for five core networks with the longest historical data, this third-party dataset revealed significant YoY improvements in reliability, with the percentage of down ports declining throughout the analysis period.

DOWNTIME RULE
Connector Reliability Threshold

Plug In America Public Charging Experience Survey

Conducted from May 22 to June 12, 2025, this survey captured qualitative and quantitative insights from 1,287 full responses and 362 partial responses from EV drivers across the United States. The survey data provided critical user experience metrics that complement our technical telemetry, including satisfaction ratings, charging behavior patterns, and pain points experienced at public charging stations. Over 97% of respondents were current EV owners or lessees, providing authentic ground-truth validation of our technical findings.

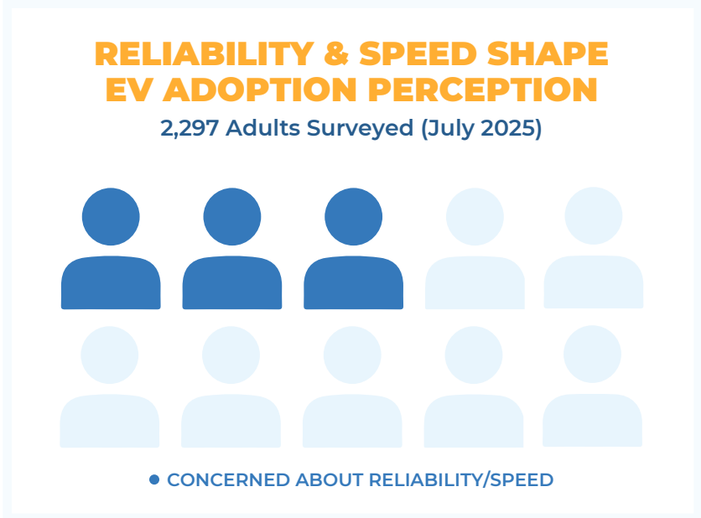


Northwind Climate U.S. Consumer Survey

The July 2025 Northwind Climate survey of 2,297 adults provided a broader market context, capturing perspectives from current and potential EV drivers. This data helped us understand how charging reliability and speed concerns influence EV adoption and public perception of charging infrastructure.

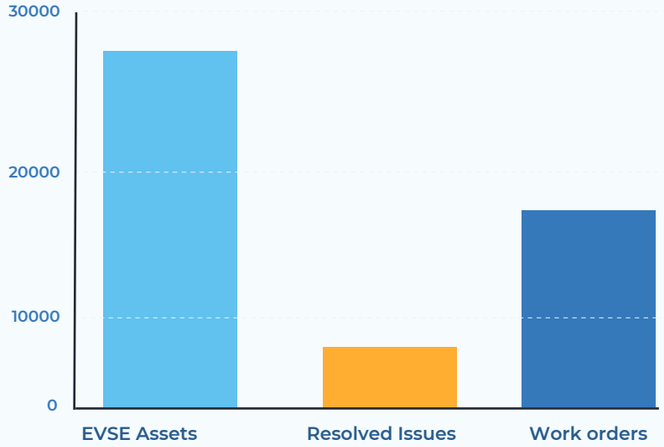
Station Age and Installation Verification Data

We analyzed 1,703 charging stations with verified installation dates to understand how equipment age impacts reliability over time. This longitudinal analysis revealed critical insights about the degradation of charge start success rates that traditional uptime metrics fail to capture.



ChargerHelp O&M Service Data

Our ongoing operations and maintenance work across 47 states continued to provide hands-on insights into station failures and recovery patterns. This dataset now encompasses ~26,200 EVSE assets with 4,453 resolved reliability issues addressed through approximately 16,500 completed work orders. Moreover, this hands-on data provides crucial ground-truth validation for software-reported station telemetry.



Charger Status vs. Charger Initiation

Methodology Evolution

Building on our 2024 methodology, we've expanded our analysis to include charge start success as a primary reliability metric alongside traditional uptime calculations. Charge start success measures the percentage of charging attempts that succeed on the first try without requiring driver intervention, troubleshooting, or multiple attempts. This shift reflects our finding that uptime alone—while improving industry-wide—fails to capture the complete driver experience.

Our analysis examined three interconnected dimensions:

Technical Performance
The gap between reported availability and actual charge start success.

User Experience
How drivers perceive and interact with charging infrastructure.

Temporal Dynamics
How station age, firmware updates, and hardware refreshes impact long-term reliability.

Unlike traditional uptime calculations that rely solely on OCPP status messages, we correlated multiple data streams to identify discrepancies between reported availability and actual charge start success.

Data Standardization Challenges

The lack of industry-wide standardization continues to complicate cross-network comparisons. Variations in how networks define and report station status, session success, and error conditions required extensive data normalization. For example:

- Some networks count a "successful" session as any interaction lasting over 60 seconds.
- Others require minimum energy delivery thresholds.
- Error code definitions vary significantly between hardware manufacturers.
- Uptime calculations differ based on exclusion criteria (e.g., utility outages, network connectivity, etc.).

Despite these challenges, the convergence of patterns across our diverse datasets strengthens our confidence in the key findings presented in this report. The combination of technical telemetry, user surveys, and hands-on maintenance data provides a comprehensive view of charging infrastructure reliability that no single data source alone could achieve.

ChargerHelp OCPP Data (2025)

2,700+ Stations
Monitored across the U.S.

100M OCPP Messages
(vs. 173K in 2024—massive growth)

~300,000 Sessions
Real-world charging attempts tracked

2,473 Active Chargers
Tracked

Multi-CPMS/CPO Data
Unified perspective across networks

Plug In America Survey (May–June 2025)

1,287 complete responses

362 partial responses

97%+ current EV owners/lessees

21-day survey window

Northwind Climate Survey (July 2025)

2,297 adults surveyed

Current + potential EV drivers

Market adoption perspectives captured

Paren Network Monitoring (Jan 2024–June 2025)

16 anonymized
Charging networks

18 months
Of historical data (five core networks)

Weekly connector-level
Reliability tracking

ChargerHelp O&M Data (Ongoing)

26,200 EVSE assets serviced

4,453 reliability issues resolved

16,500 completed work orders

47 states covered

Station Age Verification

1,703 stations with verified installation dates | Longitudinal reliability analysis enabled | Equipment degradation patterns identified

THE STATE OF UPTIME IN 2025

As the EV sector evolves at warp speed, measuring charging performance and driver satisfaction is key to improving reliability. Uptime—the percentage of time a charger is available for use or charging a vehicle—has been the most frequently used metric for evaluating whether a charger is available and operational, and for benchmarking against standards, policies, and competitors. For instance, the Federal Highway Administration's National Electric Vehicle Infrastructure (NEVI) Formula Program, which serves as a funding vehicle to states, has made the metric central to its 97% uptime mandate for EV chargers.

Yet, recent data suggests that looking at uptime independent of other critical metrics, including charge start success, gives an incomplete picture of reliability across stations, which can vary widely by age, charging speed, and location. Our analysis revealed glaring blind spots related to reliability, from charging failures occurring during "uptime" statuses to inconsistencies in how information on charger uptime is collected, shared, and applied across networks.

In this year's findings, we identified a 25+ percentage gap between charge availability and actual charge start success. We found that despite EV chargers reporting an average of nearly 97% uptime, drivers experienced charge start success at dramatically lower rates. These discrepancies between uptime statistics and the EV driver experience expose a hidden reliability crisis that's often invisible in real-time monitoring of EV charging sessions.

To unlock the barriers holding back EV adoption, the EV charging industry must reform how metrics like uptime are applied, tracked, analyzed, and compared from network to network. Our data makes a strong argument for using uptime as one of many tools to assess the state of EV charging infrastructure and gain a more exact, holistic view of charging performance and reliability.

Closing the Gap Between Uptime and Performance

Ultimately, uptime is a quantifiable measure that answers one key question: Is the charger available? Although the industry still lacks a standardized way to calculate uptime, industry data shows uptime is improving overall.

An independent study from Paren demonstrates that uptime across ports is on the upswing, with the percentage of down ports decreasing YoY. Between June 2024 to August 2025, down ports decreased from 8.1% to 3.5%, signaling that uptime improved significantly during this period.

According to Paren, this reduction in downtime is primarily due to three factors:

- New hardware installations
- Upgrades to existing charging stations
- Better maintenance strategies

8.1% DOWN PORTS → June 2024

3.5% DOWN PORTS → August 2025

As we covered in our 2024 report and emphasized in this year's findings, the age of EV charging infrastructure directly impacts whether a station is in service. In other words, the older the station, the more likely it is to experience significantly higher downtime. Preventative maintenance strategies, installing OCPP-certified equipment during site refreshes, and implementing standardized practices for firmware updates help minimize interoperability between software and hardware and flag reliability issues without disrupting existing EVSE.

Nevertheless, measuring true uptime against performance requires a deeper understanding of the metrics for gauging the quality and effectiveness of EV charging. While monitoring uptime can provide valuable insights, it also has drawbacks:

Limited context:
Uptime alone falls short of providing a complete picture of performance. A station might show high uptime but experience low charge start success rates, hinting at underlying reliability issues that uptime misses.

Short-term fixes:
Focusing on uptime can lead to quick solutions such as hardware swaps, which fail to address the root causes of reliability issues. This creates a cycle of temporary fixes instead of long-term sustainable improvements.

Data discrepancies:
The accuracy of uptime metrics is influenced by various factors, ranging from data quality to reporting practices. Inconsistent or incomplete data can lead to misleading conclusions about reliability performance.

Network variability:
The meaning of uptime can differ across networks depending on how it's measured and monitored, complicating real-time reporting on charging quality and availability.

Unlike the century-old auto industry, the EV sector is still young, and uptime is regarded as a widely accepted standard for improving reliability and establishing a baseline metric for driver satisfaction. NEVI's 97% uptime target reinforces the critical role of uptime in defining reliability for regulatory bodies.

Station uptime is here to stay, and it still plays a crucial part in helping EV stakeholders to understand the health of public charging infrastructure. It’s also important to recognize that the source of charging failures can be complicated and multifaceted. The industry must consider taking a similar multi-layered approach to measuring the complete EV user journey, from the start of a driver’s session to service delivery.

Shifting the focus to include more precise metrics, such as charge start success and charging speed, can expand the existing industry’s toolkit for enhancing the user experience and system efficiency.

FINDING 1

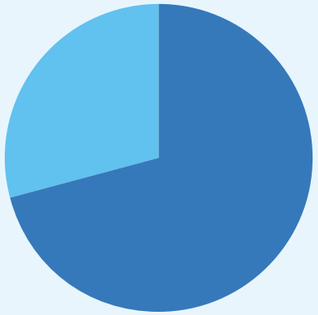
Uptime improves, but falls short of measuring the EV charging experience

Uptime is one of the most critical performance metrics for charging network operators since it represents the total time a station is operational. However, charge start success, a KPI pioneered by the ChargeX Consortium, is emerging as a more accurate signal for evaluating a station's reliability and status, and identifying factors that drive the EV charging experience.

One notable bright spot in the industry is that uptime is improving. We found that EV chargers participating in our Reliability as a Service program averaged 96.9% uptime, signalling high reliability. Likewise, Paren data saw fewer down ports YoY, another sign the EV industry is steadily maturing as EVSE sees greater consistency and reliability across the network.

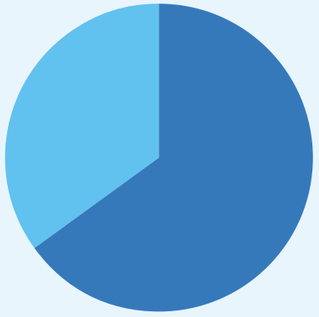
Nevertheless, our latest data analysis, a sample that included 15.8+ million OCPP messages and 109,188 individual sessions across 2,473 chargers, uncovered that uptime alone is insufficient for accurately assessing key indicators like station functionality or the EV driver experience.

Despite chargers reporting as “available” and contributing to high uptime, only 71% of charging attempts were successful. More significantly, 35% of failures occurred on chargers that appeared operational. A closer look shows that although these chargers reported an “available” status, they didn’t complete the charge initiation sequence. This variance demonstrates that traditional uptime calculations, which focus on OCPP status availability, miss critical failures during the charge start process.



CHARGING ATTEMPTS OUTCOMES

71% successful attempts
29% failed attempts



FAILURE BREAKDOWN BY CHARGER STATUS

65% on unavailable
35% on “available”

Our 2024 findings also found that true uptime is often lower than reported uptime. While a station or network might report availability, charging software consistently overestimated station uptime, point-in-time status, and the ability to charge a vehicle successfully. The discrepancies we found between a charging station's physical status and app-reported status compound the reliability issues plaguing the industry, from software inaccuracies to a lack of consumer trust in the ability to "fuel" an electric vehicle as easily as their gas counterparts.

This weak correlation between uptime and charge start success suggests that the latter is a better indicator for determining if EV drivers can charge their vehicles, even if a public charger shows connectivity, normal status, or working communications. Furthermore, with charge start success emerging as a superior metric for tracking EVSE performance and flagging reliability issues missed by uptime monitoring, the industry must re-examine our methodology for truly measuring and predicting the EV driver experience.

RECOMMENDATION 1

Adopt more precise reliability metrics and standards to improve the EV charging experience

Adopting standardized metrics and definitions for measuring charge start success is a necessary step toward eliminating confusion and frustration about network reliability, creating alignment across networks, and moving closer to an end-to-end experience that resonates with EV drivers.

2021 → 95,000 PORTS

2025 → 225,000+ PORTS

Over the past four years, the EV industry has evolved at a breakneck pace, growing from approximately 95,000 public charging ports in 2021 to over 225,000 as of August 2025. As the EV industry matures, better insight is gained into what reliability truly means, beginning with metrics that capture whether a driver can successfully charge on their first attempt.

However, the consistent implementation of OCPP standards across networks has been slow. As a result, costly interoperability failures are only discovered after deployment. And while uptime calculations might show availability, they fail to paint a complete picture of the obstacles impacting the charging experience, from failed charge sessions to payment system failures.

Without consensus on industry terminology, performance targets, or how metrics are defined or calculated, EV networks will lack the tools to detect the reliability issues affecting the driver experience. Adopting specific language that defines clear and actionable metrics, like charge start success, and establishes target reliability levels, is a practical solution for addressing this blind spot in reliability measurement.

Example:

The ChargeX Consortium recommends a set of KPIs for measuring different aspects of the driver charging experience, including charge start success. The KPI, calculated as a percentage, represents the effort required to start a charging session, is defined as the percent of charge attempts that result in an EVSE starting to deliver power to an EV.

THE REAL-WORLD EV DRIVER EXPERIENCE

Since Henry Ford revolutionized the auto industry with the Model T, the automobile has symbolized freedom, opportunity, and independence for American drivers. In most parts of the country, personal and commercial vehicles are an economic necessity and (quite literally) the driving force behind the movement of people and goods. Auto manufacturers have capitalized on this sentiment by ramping up a vast network of infrastructure that powers gas vehicles safely and reliably, making gasoline the dominant fuel for consumers and businesses.

Yet, EVs still lag far behind gas-powered vehicles as the preferred choice for the average U.S. driver, an outlier compared to countries like China and Sweden where at least half or more of the new cars sold are electric.

One notable obstacle is a lack of reliable EVSE, a critical requirement in a country designed around gas-powered vehicles. Cost and range anxiety—the fear that an electric vehicle will run out of battery power before drivers reach their destination—are additional barriers that have dogged the industry since its inception.

Overcoming the trust deficit in charging reliability and the public's hesitation in choosing electricity over the time-tested petrol industry will be key to overcoming mainstream resistance to EVs. Despite these issues, EV sales continue to climb, and most EV drivers are sticking with their choice to go electric.

A recent global EV survey found that less than 1% of EV owners polled would return to a gas or diesel vehicle. As for commercial vehicles, the transition to electric power is already well underway due to their energy efficiency and suitability for local and in-state delivery of goods and commodities.

Amid these challenges and opportunities, what is the EV driver's real-world experience, what do they care about, and how can reliability become the norm in a future where "fuel is electric"? Automotive titan General Motors (GM) offers a clue on where the industry can start, stating, "A robust and thriving EV ecosystem ensures widespread access to technology, charging, and energy management for EV drivers, all of which make EVs an even more compelling option."

> "Reliable, accessible and convenient public charging is foundational to accelerating EV adoption," said Will Hotchkiss, GM Energy's COO and head of public charging. "We believe that we have the ability-and responsibility-to solve the challenges with charging infrastructure, if we truly want customers to go all-electric."

Uptime, along with KPIs like charge start success (see *Finding #1 on page 12*), must be part of this larger strategy when measuring performance and driver satisfaction. Getting to the bottom of the charging experience means digging deeper to understand customers' needs, meeting users where they are in the user journey, and reassuring drivers that they can reliably charge their vehicles on the road.

Perception vs. Reality: EV Driver Trust in Charging Infrastructure

Decades have passed since Toyota first introduced the first mass-produced hybrid automobile. Yet, consumer trust in the reliability of electric vehicles and the charging infrastructure that supports them continues to present barriers to EV adoption.

As EVs grow in popularity, one thing is clear: reliable EVSE is essential. Drivers must trust that public chargers will work whenever they plug in at a station, and operators need charging systems that are consistent, scalable, and efficient.
Early infrastructure rollouts often prioritized speed and cost over quality and reliability. Many site hosts installed chargers without properly testing them in real-world conditions or requesting independent third-party performance data.

Some chose hardware that was ill-suited to handle a wide range of EV models or systems that lacked essential support and diagnostic tools. Software failures were frequent in these cases, and outages could last for weeks without a resolution.

These early missteps continue to follow the industry, with worries about the lack of reliable EVSE consistently ranking as a top fear among American drivers. A June 2025 Plug In America survey found that while satisfaction with public charging increased YoY (35% of those surveyed in 2025 said they're currently concerned about public charging availability and reliability versus over 40% respondents in 2024), yet there's still room for improvement. Recurring problems such as broken or nonfunctional chargers and poorly maintained stations were highlighted as major sources of frustration for EV drivers.

Average downtime across charge ports is decreasing, and uptime is improving—a positive sign for the industry. However, these observations by thought leaders show that the reliability of public charging continues to be a primary concern for drivers.

More importantly, evaluating the true health of public charging infrastructure and the EV drivers' experience requires a more comprehensive view of EVSE performance. For example, measuring a network's uptime versus charge start success can provide a more accurate snapshot of driver satisfaction since having high uptime doesn't necessarily ensure a positive or accurate charging experience.

Standardizing how the industry defines and measures uptime to reflect the real EV driver experience is a crucial first step to solving these challenges. It's not enough for a charger to be "available." When EV drivers pull up to a station, charging systems must initiate a charging session, process payments correctly, and successfully communicate with the network.

CONCERNS DECREASING
+40% (2024) → 35% (2025)
Worried about availability and reliability

UPTIME IMPROVING
Average downtime across ports is dropping

SATISFACTION RISING
Drivers reporting better experiences YoY

OCPP-CERTIFIED VENDORS

Ensure interoperability and reliability

OPEN ROAMING (OCPI/OICP)

Cross-network access and app compatibility

PREVENTATIVE MAINTENANCE

Minimize downtime and catch failures early

LONG-TERM INVESTMENT

Ensure interoperability and reliability

Increasing driver satisfaction and confidence in EVSE requires building and maintaining public infrastructure based on industry best practices like OCPP, Open Charge Point Interface (OCPI), or Open Intercharge Protocol (OICP) standards, and a vision for long-term reliability. For example, working with OCPP-certified vendors, implementing open roaming protocols, and ensuring OCPI or OICP compatibility for all networked charging solutions opens access to a wide range of e-mobility service providers. This improves station performance and flexibility, and enables EV drivers to use chargers across different networks and mobile apps.

Reliable charging translates to delivering not only operational excellence, but also a fast, convenient, and hassle-free experience. Focusing on long-term EVSE investment, preventative maintenance, and adherence to reliability standards can build consumer trust in the reliability and viability of public charging infrastructure.

Navigating Charging Variability in a Gas-Centric World

A significant swath of the U.S. general public remains reluctant to embrace electric vehicles over gas-powered options. EV charging is more complex than the gas fueling experience drivers have grown used to for over a century, making it challenging to convince mass-market consumers to move away from fossil fuels.

While strong regulatory backing, or the lack thereof, impacts wider EV adoption, the industry has suffered from a variability and fragmentation problem since its genesis. The involvement of numerous companies—network providers, site hosts, and other stakeholders—often results in a lack of clarity over who's responsible for maintenance and troubleshooting interoperability issues. Hyper segmentation of product design across hardware, software, and charging equipment hampers usability for drivers who regularly encounter broken or unresponsive screens, different plug adapters, and fluctuating charge rates.

Even as the demand for convenient EV charging increases, closed, proprietary systems create “walled gardens” that confuse drivers and erect barriers to delivering a simple charging experience. The rising cost of public fast charging prices, which is driving costs per kilometer above gasoline in the U.S. and Europe, also discourages potential drivers from adopting electric vehicles. Data-driven research has pointed to driver discontent with EV charging pricing, which can vary dramatically by station, charger type, time of day, and other elements.

Ultimately, addressing issues related to standardization and technical complexity comes down to three fundamental questions that lie at the heart of the EV driver experience:

- **Where can I charge my vehicle?** A common problem with EV charging is that plug types differ based on vehicle year, make, and model.
- **How long will charging take?** Power level variations between EVs and chargers affect charge time and speed.
- **Will the charger work?** The discrepancy between software-reported uptime and actual real-time status for available, in-use, and offline chargers is a substantial barrier to EV transition.

As the EV industry evolves with faster, more innovative technology, instilling consumer confidence in charging reliability will require more than guaranteeing uptime. Reliable EV charging happens when multiple systems work together, persuading current and potential EV drivers that electricity as fuel is as reliable and easy to use as gasoline.

Achieving this monumental shift in driver perception calls for coordinated efforts between policymakers, automotive companies, utilities, and EV charging stakeholders who must:

- Communicate the benefits and functionality of EV technology using plain, simple language that everyday users understand.
- Enact policies that enable industry players to build a driver-centric and user-friendly ecosystem, regardless of where drivers fall along the EV adoption curve.
- Encourage local dealers to boost awareness of fuel choice and how electrification works for all buying demographics.
- Increase long-term, high-volume visibility of charging stations with better marketing and advertising. While the number of EV charging stations and ports is beginning to rival gas stations, consumer awareness remains low.

Overcoming the industry's variability issue also means tackling the complexities of EV ownership across demographics and lifestyles, including vehicle ownership, geographic region, charging method, and charging location (e.g., at home or at public chargers), as well as addressing these concerns in a way that's simple and intuitive for consumers to understand. EV software company Chargeway adds, "EV charging reliability starts with consumer confidence in the viability of electricity as a replacement for gas to meet their driving needs. This will only be accomplished through simplifying what drivers need to know about charging."

All factors considered, the EV charging reliability is improving. To continue this upward trend, industry stakeholders must collaborate effectively to create the most seamless and consistent charging experience for all EV drivers, regardless of vehicle make, charging network, plug type, or locale.

From Reliability to Speed: Driver Priorities Shift

In this year's findings, charging speed has emerged as a leading factor in EV driver satisfaction. A recent survey by Northwind Climate, a data-driven SaaS platform, showed that charging availability, the key performance indicator for uptime, still ranks among the top three most common issues EV drivers encounter when attempting to charge. However, an equal percentage of surveyed drivers (30%) who identified as Climate Distressed, Millennials, and Generation X cited slow charging speeds as an EVSE limitation.

Speed also led the list of variables influencing EV adoption, with faster charging (22%) followed by greater availability (19%) as the top factors swaying drivers to boost their use of public chargers. Among potential EV drivers, 40% cited speed as their biggest concern with switching to EVs, particularly when considering charging time and availability. Yet, when asked about their charging experience, 24% of current EV drivers stated that charging times at public stations were faster than expected, and the same percentage responded that chargers were much faster than expected.

These insights imply that current EV drivers, while frustrated with long wait times at charging stations, still have positive charging experiences. On the other hand, there's a danger that slow charging speeds may discourage non-EV owners from turning toward electric vehicles as a viable and convenient mode of transport.

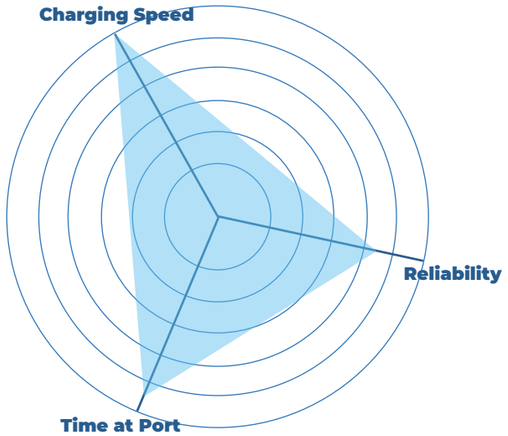
Northwind Climate summarizes the industry's call to action: "Charging station providers have a unique opportunity to reshape consumer expectations by spotlighting the reality that many public charging experiences are faster than anticipated. Bridging the perception gap—especially among segments who overestimate charging delay—can build trust, encourage more frequent usage, and differentiate themselves in a competitive infrastructure landscape."

When evaluating performance measurements for the EV driver experience, it's clear that charging speed must be part of the general calculus for understanding EV driver behavior. By combining these data-driven insights with reliability metrics like uptime and charge start success, station operators and network providers will be better equipped to inform strategies for improving reliability and meeting customer expectations at EV charge ports.

FINDING 2

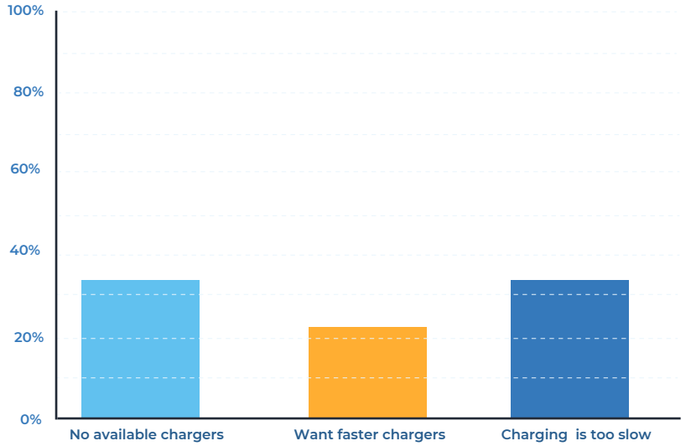
Charging speed rivals reliability as a top pain point for current and potential EV drivers

Charging reliability remains a significant hurdle in boosting EV adoption and public opinion of the industry. However, insights from charging sector leaders revealed that one metric has leapfrogged reliability in influencing current and potential EV drivers' use of charging infrastructure: speed.



In Northwind Climate's July 2025 U.S. Consumer Survey, close to one-third of surveyed EV owners reported arriving at public stations with no available chargers, with 22% of respondents saying that faster chargers would increase their use of charging stations. Plug In America discovered similar findings in its Public Charging Experience Survey on the state of the EV driver experience in the U.S. Out of nearly 1,300 responses, almost one-third of drivers answered that "charging speed is too slow."

Though Northwind Climate's study and Plug In America's survey represent only a subset of the EV driving population (Northwind Climate surveyed 2,297 adults aged 18 and older online), the growing



EV Driver Public Charging Experience to Northwind Climate US Consumer Survey

importance of indicators such as rate of charge over actual reliability metrics suggests the EV industry is reaching maturity. Moreover, factors such as time spent at the charge ports are just as crucial as charger availability in delivering a good driver experience or a bad one.

Speed also impacts perception among potential EV drivers. According to Northwind Climate, this concern is especially acute among older and climate-distressed groups and individuals facing logistical and psychological obstacles when accessing charging stations. Interestingly, nearly half of current EV drivers shared that the speed of charging experiences exceeded their expectations, saying charging times at public stations were faster or much faster than expected.

Diving further into the data, the study demonstrates that potential EV drivers perceive charging speed as a major barrier to EV adoption, despite half of current EV drivers stating high owner satisfaction with the rate of charge at stations.

RECOMMENDATION 2

Build driver trust and confidence through clear communication, simple tools, and user-centered design

Fostering collaboration and information sharing is key to overcoming negative public opinions about EV charging reliability. Creating an industry-wide campaign that provides simple, impactful messaging about the advantages of electric vehicles can lead to more trust and confidence in the driver experience and boost EV adoption.

While common misconceptions persist about EV charging infrastructure, concerns around range anxiety, charging availability, and convenience are not entirely unfounded. Moreover, with over 70 charging networks in North America, current and potential EV drivers must navigate a complex market that struggles with the following issues:

- Hyper-segmentation in product design across EV hardware and software
- Incompatible adapters and power capability issues between vehicles and chargers
- Marketing and communication failures that focus on technical complexity instead of simple benefits such as connectivity, charging speed, and pricing

Such industry challenges create a significant trust gap where users question whether they can find a working EV charging station and reliably power their vehicle near their home, work, or on the road. Chargeway, a leading voice on EV charging visibility, states, “To be truly successful and accepted by the broader public, electricity as fuel needs to be on par with gasoline in the minds of consumers: highly visible and easy to understand.”

Overcoming public skepticism and hesitation requires comprehensive, data-driven education that targets consumers, media, policymakers, and other industry stakeholders, reflecting the latest EV technology innovations. Campaigns should use consistent, industry-approved language to tell real-world success stories, showcase network expansion, and provide vetted resources that help users understand the capabilities and limitations of charging infrastructure.

Example: EV software provider Chargeway has been at the forefront of addressing charging visibility and creating user-friendly products that empower EV drivers and instill confidence in EV charging as a viable alternative to gasoline. Chargway's platform enables EV drivers to use a color-coded system that explains plug types and power levels and helps users find and check the real-time status of public chargers compatible with their vehicle.

By leveraging data on uptime, reliability rankings, new infrastructure deployments, and drivers' overall charging experience, Chargeway's platform serves as an example framework for using technology to bolster public education and stakeholder alignment on the reliability of "electricity as fuel."

FROM SILOS TO COLLECTIVE SUCCESS

The modern EV industry is now a few decades old. Yet, in many ways, it's still in the nascent stage of charging technology. Like the early years of telecommunications, the EV sector suffers from silos that hinder interoperability—seamless communication and connectivity between multiple, disparate platforms—as well as its ability to pivot and adapt to EV drivers and consumers' fast-changing needs.

In the realm of big data, consumer privacy and cybersecurity concerns regarding the use and storage of EV driving data pose serious risks to future growth and EV acceptance. Sophisticated features (e.g., trip histories, charging locations, in-cabin video footage, etc.) designed to appeal to EV owners have often been the culprits behind high-profile data breaches and class-action lawsuits.

OCPP, the de facto communication standard for implementing EV software and hardware, aims to promote compatibility and flexibility across charging stations. However, vendors claiming to be "OCPP-capable" either lack official certification or proof of protocol compliance. Without a shared nomenclature or technical baseline for implementing software and hardware, there's a greater risk of industry confusion and post-deployment failures.

A young industry also has outsized potential for making breakthrough discoveries and bold ventures that push the boundaries of what was previously thought possible. For example, the Open Charge Alliance's (OCA's) release of OCPP protocol 2.0.1 represents a big leap from OCPP 1.6J and provides robust support for scaling and managing charging stations. Its inclusion as a requirement for NEVI funding exemplifies how strong, cross-industry collaboration produces clever mechanisms for ensuring chargers meet the minimum threshold for optimal performance.

NEVI's recommendations that "chargers must conform to OCPP 1.6J or higher" and that "charging networks must be capable of communicating with other charging networks in accordance with OCPI 2.2.1" fall short of mandating certification. Still, this guidance presents an opportunity to create policies for stronger enforcement of OCPP, OCPI, and other industry standards.

Despite obvious roadblocks, solutions are on the horizon for standardizing data sharing, adopting open protocols, and implementing cutting-edge products that satisfy current EV drivers and attract future adopters. Pulling collective insights from industry peers, we found several examples of how stakeholders are leveraging collaboration and innovation to solve tough questions around reliability and operational efficiency.

EV Charging Is Getting Smarter, More Open, and More Diverse

After a series of fits and starts during the early phases of expansion, electric vehicles are finding their stride in the auto market. As oil refineries face shutdowns in EV-friendly states like California, electricity as a fuel source is becoming more accessible with the installation of new EVSE.

Even with political and trade headwinds under the Trump Administration, the number of public chargers continues to grow—public charging ports doubled between 2020 and 2024—pushing the U.S. closer to its goal of placing EV charging options on par with local gas stations.

Recent data from Ohm Analytics illustrates this growth trend. Their research showed continued growth of EV chargers, with over 33,200 L2 ports and over 5,200 L3 ports deployed during Q2 2025 in the U.S. across public and private charging sites. This represents a 25% YoY increase in total charge ports deployed.

25%

YoY INCREASE

in total ports compared to last year

Where federal support is waning, local- and state-backed incentives such as the New York State Energy Research and Development Authority's (NYSERDA) programs are helping to bridge the gap for EVSE funding. For instance, the Charge Ready NY program offers rebates for purchasing and installing Level 2 (L2) EV charging stations and direct current fast chargers (DCFC) at workplaces, multi-unit dwellings, public parking facilities, and hotels or motels.

Installing chargers can be expensive, ranging from $2,200 per port for L2 commercial chargers to over $351,000 per port for high-powered DCFCs. Short payback windows, which often lead to lucrative returns, make incentives like NYSERDA a popular and primary driver of EVSE construction at the state level.

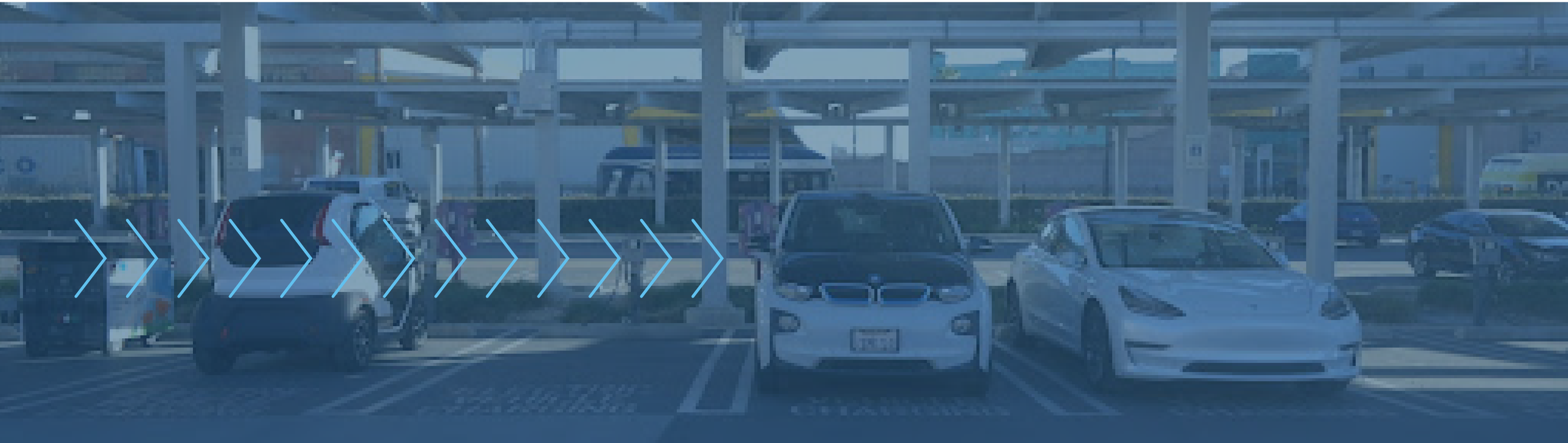
While public incentives help shoulder the cost of EVSE, recent market exits by legacy network providers, including Enel X Way, the maker of JuiceBox chargers, EVBox, and Shell Recharge, are shaking up the EV charging market in North America and Europe. These departures also hint at the industry's ongoing revenue challenges and the steep price of running EVSE operations and replacing aging charging infrastructure.

The sudden closing or scaling down of charging operations can leave stations with stranded assets, forcing operators to search for support from alternative software and hardware vendors. Without systems to handle essential functions such as payments or real-time diagnostics, site hosts and EV drivers are left in limbo at shopping centers, parking garages, and other places of business. The fallout can result in financial and reputational damage and undermine industry efforts to improve the reliability of existing charging infrastructure.

Nevertheless, this volatility leaves a vacuum for smaller, lesser-known players to fill. For example, Blink Charging offers warranty and maintenance programs that allow former Enel X customers to swap out their JuiceBox chargers for free. OCPP 2.0.1 removes additional barriers for OCPP-powered chargers, enabling sites to easily transition to network providers that are more reliable, flexible, and affordable than larger, more established vendors.

Another notable trend is the incoming wave of EV stations and fleets with legacy assets that must be replaced or expiring service contracts and leases. Station operators will need network providers for site refreshes and upgrading low-powered chargers with faster, more advanced technology that easily scales and maximizes uptime. For many industry players, this presents a unique opportunity to increase their market share and charging footprint.

Against the backdrop of continued growth, regulatory uncertainty, and constant disruption, market winners and losers will emerge in the EV charging race. Who ends up on top depends on EV stakeholders' ability to adapt to driver expectations and evolving trends, retire aging EVSE with future-proof technology, and adequately plan for the design, rollout, and maintenance of charging networks.



Collaboration Leads to Improved Reliability

Increasingly, the EV industry has turned to diversification and white labeling to fortify supply chains and stay competitive in a rapidly changing environment. In contrast, there's speculation that diversification may threaten the dominance of current EV market leaders as they face intense competition both domestically and in overseas markets like China.

Some of the auto industry's most prominent companies are answering those questions with more collaboration across products, technology, and experience delivery. Amid industry complexities and challenges, cross-sector collaboration provides several key benefits:

Improved market position, customer value, and charging reliability

Consolidated resources and expertise around creativity and innovation

Enhanced competitiveness in developing and mature markets

A newly formed partnership between U.S.-based GM and the Korean automaker Hyundai aims to reduce costs and accelerate product development of new vehicles, including EVs. GM, EVgo, and Pilot Company, a travel center and fuel supply operator, collaborated to deploy close to 850 EV fast charging stalls over two years. The collaboration resulted in the launch of more than 200 fast charging locations across nearly 40 states.

> *"Reliable, accessible, and convenient public charging is foundational to accelerating EV adoption."*
>
> – Will Hotchkiss, COO and Head of Public Charging, GM Energy

NACS, or Tesla's North American Charging Standard, is leading the way in standardizing charging ports, which is a significant pain point for charging reliability and usability. Major automakers have partnered with Tesla to equip their EV vehicles with NACS DC adapters, providing drivers with a faster, frictionless experience when plugging in at stations.

In the EV world, the cost of operating in silos can be high, from lost creativity to stunted innovation. As EV companies diversify across sectors, significant challenges remain around EVSE reliability, market growth, and adoption. However, strategic collaborations are laying the framework for how different sectors can work together to solve problems around charging reliability and the driver experience.

The Rise of OCPP

OCPP is an open-source communication protocol that enables EV chargers and charging management systems to work together seamlessly. In addition to ensuring interoperability across various systems, equipment, and utilities that power charging stations, OCPP is patent- and royalty-free.

Aside from making it easier for stations to switch software and hardware companies, OCPP-certified software and hardware can minimize the cost of ripping out and replacing EVSE, which often turn into million-dollar projects.

When Enel X Way announced its departure from the U.S. market, thousands of charging ports were left with stranded assets. Many of these charging ports, which ran on proprietary software, had to be swapped out with operational units or were abandoned altogether. Others were rescued by EV charging software providers such as ChargeLab, which migrated 1400+ orphaned chargers after Enel X shut down its North American operations.

As of January 2024, 60% of the L2 charging ports in the U.S. ran on locked charging management software. However, Ohm Analytics shows this figure on a downward trend—by the end of Q1 2025, the number of L2 charge ports running on locked platforms dropped to 50%.

Furthermore, Ohm Analytics states, “The data shows that not only has the industry learned its lesson on locked CMS platforms, but that OCPP-compliant products are now selling better than non-OCPP products.”

Since its formation 15 years ago, OCPP has been widely adopted across the EV ecosystem, reflecting the industry’s gradual shift toward more open communication standards. Regulatory bodies like the California Energy Commission mandate that all vendors participating in the California Electric Vehicle Infrastructure Project (CALeVIP) give proof of OCPP certification to ensure EV charging installs under CALeVIP are open and accessible. For utilities, OCPP certification helps stations manage grid reliability through demand response, throttling charging during peak demand and boosting charging when energy levels are high.

Due to the vision of OCPP’s creators at ElaadNL, the leadership of the OCA, and extensive collaboration between the private and public sectors, the EV industry has a standard, tech-agnostic platform leading the way to more reliable, resilient charging infrastructure.

FINDING 3

Hardware swaps deliver temporary gains rather than long-term resiliency

Our analysis of 1,703 charging stations confirms that site refreshes may boost short-term performance but fail to address the deeper coordination problems between hardware and software.

Charging reliability doesn’t hinge on one layer alone. Stations built based on outdated standards often lack the architectural headroom to support evolving protocols, while software updates frequently outpace what older components can handle. This misalignment leaves equipment technically “online” but functionally unreliable for EV drivers.

In practice, EVSE reliability depends on everything from processors and connectors to firmware, payment systems, and communication protocols. When one piece falls out of sync, the entire charging experience suffers. The industry’s siloed approach for upgrading hardware masks these interdependencies, which produces stranded assets and incorrect uptime data, and erodes driver trust.

RECOMMENDATION 3

Form local OCA-style teams to align firmware updates and protect drivers

Establish a local working group modeled after the ChargeX Consortium, Alliance for Transportation Electrification, or OCA to coordinate firmware updates and hold software and hardware network providers accountable through shared processes and learnings.

Because charging reliability depends on many interdependent layers, solving it requires the cooperation and collaboration of multiple vendors. Therefore, hardware and software network providers must be held accountable collectively.

Specifically, local working groups would:

Test and verify updates using the OCA Conformance Test Tool before releasing firmware.
Enforce certification so “OCPP-capable” means proven compliance across hardware and software.
Create future-proof practices, enabling charging stations deployed today to adopt tomorrow’s standards (e.g., OCPP 2.0.1, ISO 15118) without requiring a complete replacement of EV chargers.
Protect consumers by ensuring chargers remain interoperable and functional even as technology evolves.

This targeted, collaborative approach shifts reliability from ad-hoc fixes to a structured safeguard for EV drivers. By aligning hardware and software under one shared framework and advisory community, the industry can deliver on the promise that every charging session—not just every station—works.

INSIGHTS AND PERSPECTIVES

Our Annual Reliability Report is firmly rooted in data. However, we understand numbers alone cannot fully capture the complexity of charging reliability in the real-world driver experience.

This year, we've included a new section focused on insights and perspectives from subject matter experts—network providers, fleet and operations leaders, long-standing industry figures, and innovators—at the forefront of ensuring EVSE reliability.

Whereas our findings reveal the limits of measuring uptime absent other metrics like charge start success or the growing importance of charging speed, these stories illustrate how leaders are addressing these challenges with practical solutions while instilling confidence in the EV industry's problem-solving capabilities.

These examples also serve as an inspiration and a call to action, reminding us that building a mature and trusted charging ecosystem depends as much on data as it does on lessons and success stories from the field and the integral role of each stakeholder in our industry's progress.

- **Dunamis Charge**: Safe, Reliable, Smart, and Simple: Architecting Reliability in EV Charging
- **Rue Phillips SkillFusions**: Reliability and Adoption: What Have We Learned in 30 Years?
- **AMPECO**: Ensuring Network Reliability With AMPECO's Issues Detection Toolkit
- **Mobility House**: Optimizing Network Configuration for Charge Management Reliability
- **Wevo**: Reliability in EV Charging: Beyond Uptime and Toward Trust

Ensuring Network Reliability With AMPECO's Issues Detection Toolkit

By AMPECO

Charge Point Operators (CPOs) face growing operational complexities and reputational risks as their network of charging stations expands. Relying on a fragmented, reactive approach to managing network health, CPOs often struggle with siloed information, slow response times, and an inability to track the full scope of infrastructure problems.

AMPECO's Issues Detection toolkit offers centralized operational management. This module uses a proactive approach to quickly resolve issues, safeguarding both revenue and customer trust.

Challenge: The Hidden Costs of Reactive Operations

As CPOs scale to thousands of stations, traditional methods of managing charging infrastructure prove insufficient. Teams are inundated with a constant stream of problems, ranging from hardware malfunctions and network connectivity issues to payment failures and software glitches.

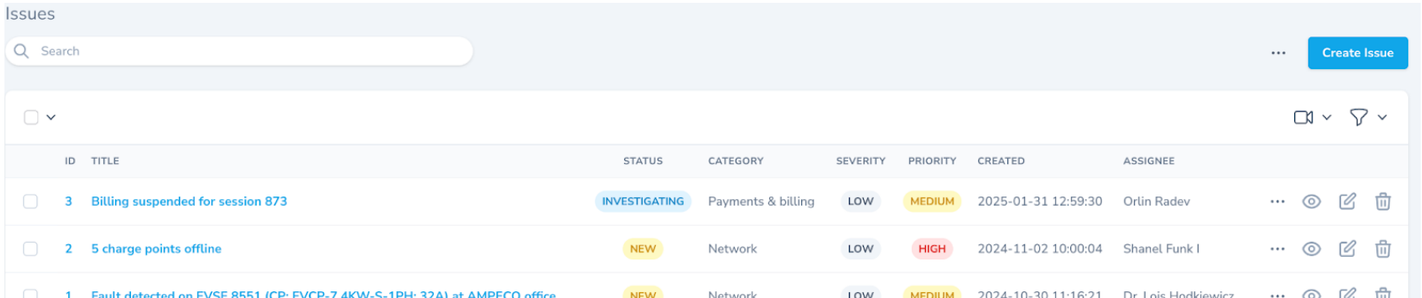
These issues were tracked across multiple disconnected systems, making it nearly impossible to gain a unified view of network health. Moreover, they hurt EV driver sentiment and brand loyalty.

In addition, this reactive approach:

Decreases financial stability: Every minute a charger is offline results in lost revenue, while the fragmented workflow leads to costly delays in resolving issues.

Reduces operational efficiency: Operators waste valuable time coordinating across disparate systems for customer service, maintenance, and inventory management, slowing down response times.

Erodes customer trust: Malfunctioning chargers lead to frustrated EV drivers, negative reviews, and lost confidence in the network's reliability, directly impacting customer acquisition and retention in a competitive market.



Solution: A Centralized Command Center for Network Health

AMPECO's Issues Detection toolkit acts as a command center, enabling the CPO's administrators to automate the creation, assignment, tracking, and resolution of major issues across the charging network.

The core of the solution is a comprehensive framework that categorizes issues into six key areas:

Network infrastructure: For connectivity, hardware, and communication problems.

Payments & billing: To track transaction and billing discrepancies.

Product offerings: To manage service-related concerns like app functionality or loyalty programs.

EV driver user experience: For addressing customer-facing usability issues.

Security: To monitor cybersecurity and physical security vulnerabilities.

Other: A flexible category for miscellaneous issues.

The Issues Detection module integrates seamlessly into the CPO's daily operations, establishing a clear and structured workflow.

1. Manual Creation: Operators can manually create a new issue for any problem they encounter or that's reported by a customer.

2. Structured Workflow: Every issue follows a structured lifecycle, from **Open** to **Investigation, Resolution**, and finally **Closed**, ensuring accountability and visibility at every stage.

3. Prioritization: A dual-classification system with configurable **Severity** levels (e.g., Severe, High) and **Priority** assignments (e.g., Highest, Low) ensures that critical infrastructure problems receive immediate attention.

4. Advanced Tracking: The system provides a full-featured interface with robust filtering capabilities, allowing teams to quickly find and focus on specific types of issues while maintaining an overall view of network health. Every issue is meticulously documented, creating a valuable knowledge base for future analysis.

Results: Proactive management delivers strategic insights

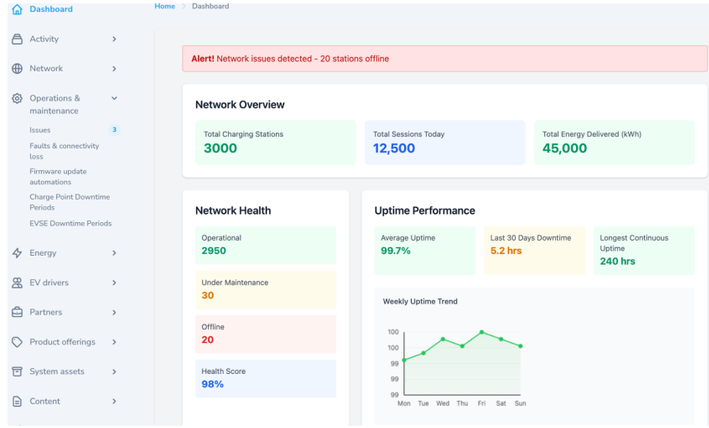
The implementation of AMPECO's Issues Detection feature has yielded immediate, lasting benefits for numerous CPOs in Europe, North America, and the Asia-Pacific region:

Enhanced operational efficiency: The centralized platform eliminated the need for fragmented systems, saving valuable time and reducing manual effort. Operators could now track all network problems in one place, enabling a more consistent and efficient response.

Improved accountability: The module's assignment capabilities established clear ownership for every issue, eliminating confusion and ensuring problems were handled by the right personnel.

Proactive network management: By capturing and categorizing issues systematically, CPOs gained valuable data on network performance patterns. This enabled them to make informed decisions about infrastructure investments and maintenance schedules, moving from a reactive to a proactive operational model.

Building operational confidence: The Issues Detection feature is the first step toward a fully automated system, offering automatic detection rules for hardware faults and offline chargers.



By centralizing issue management, CPOs solve immediate operational challenges and lay the groundwork for a more intelligent, reliable, and data-driven charging infrastructure. The result is a more resilient network that protects revenue and builds customer trust and loyalty.

Safe, Reliable, Smart, and Simple: Architecting Reliability in EV Charging at Dunamis Charge

By Dr. Donna L. Bell, Chief Product Officer, Dunamis Charge

The transition to electric vehicles is more than a shift in transportation—it's transforming infrastructure, energy, and community access. At Dunamis Charge, we recognize charging stations are not just machines delivering electricity; they're gateways to a reliable, inclusive, and sustainable EV ecosystem.

We view reliability through four pillars: Safe, Reliable, Smart, and Simple. These principles guide our design and development process, shaping how we engineer products, interact with communities, and prepare for the long-term resilience of our products and services.

Safe: The first principle of reliability

Safety is about preventing accidents and empowering quick, correct responses when the unexpected occurs. At Dunamis, our system V-model development approach ensures every design decision ties back to clearly defined safety requirements.

We start with customer needs and translate those into engineering requirements, hardware specifications, and test procedures. Rigorous design reviews, fault tree analysis, and accelerated life testing catch issues long before a station reaches the field. Safety also extends to usability, with clear instructions, intuitive connectors, and physical designs that reduce error and fatigue.

ChargerHelp's buyer's report, Architecting a Reliable EV Ecosystem, emphasizes error code standardization and back-end transparency as critical to safe operations. Similarly, Dunamis is embedding meaningful diagnostic codes and remote monitoring into our software stack, ensuring maintenance teams not only detect issues, but also know what problem to troubleshoot next.

Reliable: Building confidence into every charge

Reliability means a driver successfully charges their vehicle on the first attempt: a driver plugs in, and it works. This seems simple, but achieving it is complex.

We define reliability as uptime and consistent performance across thousands of sessions, weather conditions, and user scenarios. Our organization goes beyond compliance by seeking full OCPP 2.0.1 certification and ensuring interoperability through independent verification. This prevents hidden failure points that only surface after deployment, minimizing customer frustration and saving operators from unnecessary truck rolls.

Reliability also requires long-term thinking. We plan for efficient repair strategies, including parts availability and modular replacement, to ensure EV charging stations aren't stranded if suppliers exit the market. Moreover, training and certifying local technicians on our hardware keeps repair knowledge accessible, reduces downtime, and creates community resilience.

Smart: Data-driven design and operations

Today's charging station is an electrical device and node in an intelligent energy ecosystem. Being "smart" means anticipating change, managing complexity, and giving stakeholders visibility.

At Dunamis, smart design begins in development. Using the V-model, we validate requirements at every step, ensuring that what we design and build integrates seamlessly with smart grid features like ISO 15118 Plug&Charge. We don't design for yesterday's standards but for tomorrow's ecosystem.

Our process requires rigorous testing, release notes, and

notifications for every firmware change. Additionally, smart reliability gives customers full visibility into system performance.

Smart also means equity, which is critical for communities that have historically been left behind in technology transitions. Designing interoperable stations that enable roaming, flexible payment models, and broader adoption ensures drivers and communities aren't limited to closed networks restricting their choices.

Simple: Human-centered design thinking

Reliability must be simple for drivers, site hosts, and EV technicians. Complexity breeds failure while simplicity builds trust.

This is where design thinking becomes essential. We bring customers, technicians, and community leaders into our development cycles, testing early prototypes and incorporating their feedback. Simple is not minimal, but intentional, with every button, screen, and connector designed for clarity, accessibility, and inclusivity.

Simplicity is achieved when technology speaks the language of its users, not just its engineers. For drivers, it's a charging process that's as easy as filling a gas tank. For site hosts, they're dashboards that show clear uptime metrics and actionable error codes. And for technicians, these are intuitive modular designs that can be serviced quickly without specialized tools.

Architecting a reliable future

Reliability isn't a checkbox; it's a culture. It's how we design, test, partner, and serve communities.

Holding to Safe, Reliable, Smart, and Simple principles and aligning with the reliability framework advocated in ChargerHelp's buyer's report, we're helping to architect charging stations and a trustworthy EV ecosystem.

Every successful charge is a small promise kept to a driver, site host, or city. When multiplied across thousands of stations, those promises form the backbone of trust in electric mobility. That trust accelerates adoption, closes equity gaps, and leaves the world better than we found it.

Rue Phillips SkillFusions: Reliability and Adoption: What Have We Learned in 30 Years?

By Rue Phillips, Co-founder & President, SkillFusion

My journey as an EV industry ambassador and evangelist began in 1995, and it has truly been a rollercoaster. I've witnessed administration changes, shifting policies, and countless stop-start cycles in deployment. Throughout it all, reliability has remained a central theme.
In 1995, I joined an exclusive team designing, installing, and servicing EVSEs across Southern California under the state's Zero Emission Vehicle (ZEV) mandate. Even in those early days, reliability was the primary concern. Range anxiety was minimal, since programs run by Edison EV and automakers provided drivers with EV home chargers. EV owners were pioneers, planning trips with a Thomas Guide and happily working around the limitations.

Moreover, public charging was free, and the equipment lacked network communications. But chargers still broke down often. That set the tone for what has persisted for decades: keeping chargers working is more complicated than it looks.

Thirty years on

Fast forward to today, and technology has advanced immensely. Yet, we're still plagued by reliability issues. To Tesla's credit, its proprietary network has proven more dependable than others, solving some problems that continue to challenge the rest of the industry.

The numbers tell a sobering story. With roughly 292 million vehicles on U.S. roads and about 1.4% of them BEVs (around 4 million), there are approximately 226,000 public charging ports (Level 2 and DCFC).

However, third-party reports estimate that 27% of those ports are broken or unavailable. That leaves only about 165,000 functional chargers—roughly one port for every 24 EVs, or 0.04 ports per EV. Put differently, if nearly one-third of gasoline pumps nationwide were out of service, there would be public outcry. Yet in EV charging, this is today's reality.

Slowing sales

Sales trends reflect this infrastructure challenge. In January 2025, EV sales were growing at 15% year over year. By September, that growth had fallen to just 1.5%. While still positive, the slowdown is concerning.

Several factors explain this trend:

· Higher upfront costs compared to ICE vehicles
· Limited and unreliable public charging infrastructure
· Lack of model availability
· Concerns about resale value
· Major manufacturers scaling back EV production
· Limited public awareness and education

Compounding this are shifting policies and inconsistent regulatory support. It's worth asking: Should an industry of this scale have been built on taxpayer-funded incentives alone? Regardless, it's clear that reaching the aggressive 2030/35 mandates will be a heavy lift requiring significant change.

Reliability challenges

Among the biggest obstacles is charger reliability. Data from organizations like ChargerHelp point to recurring issues:

· Network communication failures
· Broken cables and paddles
· Screen and card reader malfunctions
· Payment system errors
· User errors

Adding to these challenges is a shortage of trained and certified EV technicians. To meet projected targets, the U.S. will need an additional 80,000 technicians—a workforce we currently lack.

This skills gap presents an opportunity. Contractors and electricians pivoting into this field now will be well-positioned to benefit from rising demand. As AI disrupts traditional white-collar professions, there may even be a new wave of workers entering the skilled trades. I foresee a future where the “Smart Home Technician” trained to install and service solar, battery energy storage, and EV equipment becomes a standard profession.

Looking forward

Despite the frustrations, I remain optimistic. Next-generation EVSEs will be more robust, reliable, and user-friendly, repairing much of the damage caused by today’s poor uptime rates. Though it’s disheartening that we’re still facing these problems three decades on, there’s undeniable progress. EV adoption continues, investment in charging grows, and new talent is entering the industry.

The road has been long and bumpy, but if history has taught us anything, it’s that persistence drives transformation. Thirty years of lessons tell us this: the EV movement is not a passing trend, but a revolution that will endure. And while the journey is far from over, there’s still a bright light at the end of the EV tunnel.

Optimizing Network Configuration for Charge Management Reliability

By The Mobility House

As fleets move beyond pilots into implementing full-phased electrification, they increasingly rely on charge management systems (CMSs) to manage critical functionalities, from error management to load management to cost optimization.

For fleet managers who heavily depend on this software, it's critical to understand the effects of network responsiveness and reliability on system performance, and how charging system architecture should be built to support safety.

A 2023 report from J.D. Power found that connectivity is the number one cause of failed charging sessions, at 55%. Another study from Qmerit also found that 55% of unsuccessful charge sessions could be attributed to station connectivity issues.

Therefore, the faster a charging management system's network processes and transmits data, the safer it is, and the more optimization cycles can be executed.

Packet loss affects network stability over time

Packet loss occurs when there are gaps in the data that's communicated from the charger to the back end, or from the CMS to the charger. Packet loss can be caused by intermittent network connectivity or overloaded network equipment and contributes to losses in system efficiency, threatening vehicle readiness and charging cost optimization.

When packet loss occurs, the system must retransmit the sent data and wait for a response confirming that the data has arrived. All data in the queue is stalled as the system waits for a response.

This stalling can cause a system to lag, even when network connectivity is restored. This system lag slows down the speed at which a CMS responds to dynamically changing power levels in real time.

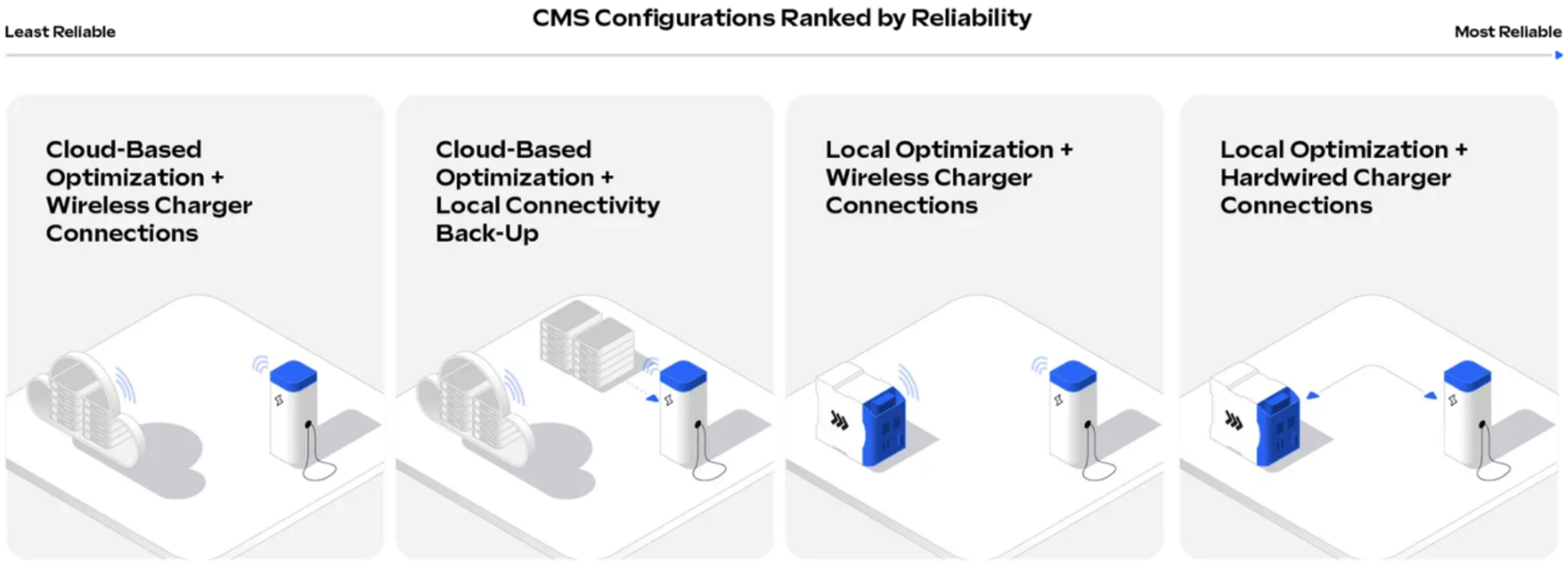
Zero packet loss is an attainable goal for a CMS network with local optimization and Ethernet-connected EVSE. Wireless communication from EVSE to CMS local controller is the next best configuration, reducing packet loss due to communication to cloud.

Round-trip data processing time is critical for charging network reliability

Round-trip data processing time describes the length of time it takes for the CMS to receive information and return commands to the EVSE. The most efficient configuration for a CMS is to have charge optimization logic processing on-site, with Ethernet cables connecting EVSE and the local controller.

This setup enables the CMS to achieve round-trip times of one to five ms, effectively increasing the speed of electricity generation. A wireless connection from EVSE to local controller is less consistent. However, with a strong signal, this architecture can achieve 10 to 30 ms round-trip data processing times.

Even with a strong signal, wireless connectivity of the CMS controller to charger will always be vulnerable to site conditions such as rain, electromagnetic interference, bandwidth competition, or vehicles. The LTE standard is even less consistent and only achieves 50 to 100 ms round-trip times, even at peak performance.



If charge optimization is occurring in the cloud instead of a local controller, roundtrip data processing becomes much longer as data travels to and from the server where optimization occurs.

Local control with local optimization and Ethernet-connected EVSE has proven to be the highest standard of reliability in networking configuration for charge management.

The functional safety requirements of load management for power capacity oversubscription are pushing the EV industry and utilities toward local-control-based solutions. This trend is reinforced by the UL 3141 Outline of Investigation draft, which mandates a local controller for power control systems.

The 2026 version of the National Electrical Code is expected to require UL 3141 certification for power control systems used to oversubscribe sites. As local-control charge management systems become the standard configuration across the industry, we'll see the benefits of stronger, faster network connectivity, improving daily system performance, reducing failed charges, and delivering more consistent charging optimization.

Reliability in EV Charging: Beyond Uptime and Toward Trust

By Wevo

The industry is shifting from “install and walk away” to something more profound: install, and continue to ensure that EVSE works reliably over time. That’s the essence of true reliability.

For drivers, it’s the confidence that EV charging works the first time they pull up to a station. For fleet managers, it’s knowing vehicles will be ready at the start of a shift, without exception. For utilities and site hosts, it’s the assurance that infrastructure won’t buckle under peak demand. In every case, reliability is the expectation that EV charging infrastructure works without fuss, frustration, or failure.

For years, our industry tried to measure reliability with a single metric: uptime. If a charger was online, it was considered reliable. But anyone driving an EV knows the story isn’t so simple.

A charger can be “up” but still fail because of a software error, a communication gap between systems, or an authentication process that confuses the driver. Uptime tells us something, but it’s not enough. As EV adoption accelerates, reliability must evolve from a narrow technical measure to the broader promise of trust and predictability.

We see this daily across the 50,000+ chargers our platform helps manage. Multifamily properties, workplaces, public destinations, and fleet depots highlight the same lesson: reliability is not about any single device but the entire system working together. A smooth charging experience requires hardware, software, operations, and energy infrastructure to align in ways that most drivers never see. And that’s exactly the point.

One of the most overlooked aspects of reliability is energy management. Early in the EV rollout, load management was seen mainly as a way to cut costs by avoiding expensive grid upgrades. But in practice, it also keeps sites resilient when demand spikes.

Facilities that use adaptive energy allocation can install many more chargers without tripping breakers or overloading transformers. We’ve seen sites achieve up to 60% energy savings while ensuring every driver gets the charge they need. In other words, reliability is about keeping chargers online and making sure power flows where and when needed.

Fleets put this to the test every single day. Pacific Gas & Electric (PG&E), one of the largest U.S. utilities, is electrifying its 9,500-vehicle fleet with the help of Wevo Energy to meet ambitious net-zero goals. For PG&E, reliability isn’t abstract; it’s the difference between service trucks rolling out on time or sitting idle in a depot.

Working together, we helped PG&E implement a system that optimizes charging schedules, balances loads across sites, and gives operators real-time visibility into charger performance. The result was efficiency and assurance that PG&E vehicles are consistently ready for the road. For fleet managers, that peace of mind is what reliability looks like in practice.

If there’s a single lesson to draw from, it’s that technology alone isn’t enough. Reliability must be built into operations, enabling operators to see issues before drivers encounter them. It means designing user experi-

ences that make authentication and billing invisible so drivers focus on their journey rather than the process. And it means using data to predict and prevent failures rather than reacting to them.

Most importantly, reliability is not the responsibility of any one stakeholder. Drivers, operators, utilities, and technology providers each experience it differently, but their needs are deeply connected. The driver's successful charging session depends on the operator's tools, which rely on the software's intelligence, which depends on the grid's stability. The industry is starting to recognize this interdependence, moving toward open standards, hardware-agnostic platforms, and collaborative approaches that treat reliability as a shared outcome.

Looking ahead, reliability will be measured less by whether chargers are online and more by whether the system as a whole delivers on its promise. That requires broader metrics, including successful session rates and user satisfaction, grid-integrated solutions that keep public charging aligned with renewable energy and capacity constraints, and business models that embed reliability into contracts and service-level agreements.

Reliability may not be glamorous, but it's the foundation of EV adoption. Without it, EV drivers lose confidence, fleets hesitate, and site hosts second-guess investments. With it, charging becomes invisible and a part of daily life that works as expected. That's the goal we should all aim for—not uptime percentages, but trust in the system itself.

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Epic Charging
Chargeway
DUNAMIS CHARGE
NORTHWIND Climate
SkillFusion
paren
Ohm Analytics
wevo
general motors
AMPECO
Plug In America
THE MOBILITY HOUSE

About ChargerHelp

ChargerHelp (CH!) is fixing the single greatest barrier to faster electric vehicle adoption: the charging experience. As the first company exclusively dedicated to EV charging infrastructure operations and maintenance, we're working with the entire EVSE value chain to make a positive charging experience the norm. We aim to achieve that objective through our EMPWR technology platform, purpose-built for your charging station's O&M needs.

ChargerHelp provides flexible Reliability-as-a-Service (RaaS) solutions tailored to your specific business goals. Since our inception, we've maintained thousands of chargers for major networks, utilities, and OEMs across 47 states, and assessed and repaired over 30,000 EV charger failures.

For more information, please visit https://www.chargerhelp.com/.