

WHITE PAPER

HOW IIOT CONNECTIVITY IS REVOLUTIONIZING ELECTRIC VEHICLE CHARGING

IIoT connectivity is enabling smart charging that's faster, more efficient, and convenient. Imagine pulling up to charge and having your payment automatically deducted while your EV's battery is optimized based on your driving schedule.

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Executive Summary

The electric vehicle (EV) charging station market has witnessed a remarkable surge in recent years, driven by the global transition towards cleaner and more sustainable transportation options. In 2022, the market was estimated to be worth approximately USD 26.9 billion, and it is projected to experience substantial growth, reaching around USD 344.61 billion by 2032, with an impressive Compound Annual Growth Rate (CAGR) of 29.1% from 2023 to 2032. This growth trajectory highlights the tremendous opportunities and attractiveness of the EV charging station market.

The electric vehicle (EV) charging station market is experiencing remarkable growth, underpinned by several key drivers,

1. Growing Adoption of Vehicle-to-Grid (V2G)

Technology: V2G technology is transforming the EV landscape, allowing for bidirectional energy exchange between EVs and the grid. With V2G, EVs can store and discharge unused energy, improving electrical component performance and enhancing the overall value of electric vehicles.

2. Increasing Emphasis on Sustainability:

Sustainability is a driving force behind the adoption of EV charging stations. Installing these stations not only demonstrates a commitment to sustainability but also aligns with environmental goals. Providing smart EV charging infrastructure with dashboards for energy optimization is a significant component of sustainability efforts.

3. Development in EV Infrastructure: Manufacturers are making strides in enhancing EV infrastructure. Cloud-based app connectivity allows users to easily locate nearby charging stations, benefiting both EV users and charging station operators. This development promotes the growth of EV charging infrastructure, making it more profitable and accessible.

EV Charge Forecast in 2030

128.13 billion Us Dollars

EV charging was worth around 14.5 billion U.S. dollars in 2021 and is expected to have a compound annual growth rate of 28.21 percent between 2022 and 2030.

Global Revenue per EV Charging Station

+130.68 percent

The global revenue per electrical vehicles charging station was forecast to continuously increase between 2023 and 2028 by in total 2.3 thousand U.S. dollars (+130.68 percent) .

2.7 million

At the end of 2022, there were 2.7 million public charging points worldwide, more than 900 000 of which were installed in 2022, about a 55% increase on 2021 stock, and comparable to the pre-pandemic growth rate of 50% between 2015 and 2019.



Introduction to The Electric Vehicles Charging Industry

The electric vehicle charging industry is evolving rapidly. Not long ago, EV charging was a tedious process, often taking hours to fully recharge a vehicle. Today, IIoT connectivity is enabling smart EV charging that is faster, more efficient and convenient.

IIoT or the Industrial Internet of Things refers to the connectivity between industrial equipment and smart devices. When applied to EV charging, IIoT connectivity allows chargers to communicate with each other and the electric grid in real time. This communication network provides valuable data and insights that improve the charging experience for EV owners.

Faster, Smarter Charging

IIoT-connected "smart chargers" can automatically adjust charging speeds based on the electric grid's energy demand and availability. They charge EVs at the fastest rate possible while avoiding straining the grid. Smart chargers also allow EV owners to schedule charging during off-peak hours when energy is cheaper, often while they sleep.

An Improved Charging Experience

With IIoT, EV owners can easily monitor and control charging via mobile apps. They can check a charger's status, start or stop a charge, set charging schedules, and pay for charging sessions directly through the app. IIoT connectivity also provides charger operators with data to monitor performance, diagnose issues remotely and schedule preventative maintenance. This results in a more reliable, seamless experience for EV drivers.

While IIoT-enabled smart charging is still emerging, it is poised to revolutionize the EV charging experience with faster, more efficient and convenient charging options for eco-friendly drivers. The future of electric mobility is connected.

How Connected Charging Stations Work

Connected charging stations are the future of EV charging. Thanks to IIoT connectivity, charging station owners and EV drivers alike can benefit from an enhanced experience.

Real-Time Data and Monitoring

Connected charging stations provide constant data on usage, uptime, and performance to station owners. They receive alerts if a station goes down so they can dispatch repairs immediately, reducing downtime.

EV drivers can see in real-time which stations are available and operational before they arrive. No more wasting time driving to a station only to find it non-functional! Interactive maps show the location and details of each port so you can easily find an open one that suits your needs.

Smart Scheduling and Billing

Connected charging solutions enable smart scheduling and billing options for both station owners and drivers.

Owners can adjust pricing based on demand to maximize station utilization during off-peak times. They can also offer membership plans and loyalty programs to frequent customers.

For drivers, connected stations provide a simple billing experience. No more fumbling with payment terminals or keeping cash on hand. Your payment info is securely stored so charging your EV is as easy as tapping your phone or swiping an RFID card.

Over-the-Air Updates

One major benefit of IIoT connectivity is the ability to provide over-the-air (OTA) updates. This allows charging station owners to remotely update software, security patches, and new features to all their connected stations at once. No technician required.

OTA updates future-proof charging stations by enabling the rollout of new capabilities over time. This helps owners get the most from their investment as technology evolves.

Overall, IIoT-enabled charging stations are transforming the EV charging experience with smart, data-driven conveniences for both businesses and drivers. The future of charging is connected, and just getting started.



Real-Time Data Collection and Analysis

The IIoT connectivity of smart EV chargers allows for real-time data collection and analysis, providing many benefits.

Monitor Usage and Optimize

By connecting EV chargers to the IIoT, station owners can monitor usage patterns and trends to optimize station placement and charger deployment. Knowing when and where EVs are charging helps determine ideal locations for new stations and the appropriate mix of charger types. The data also helps forecast future charging needs so infrastructure can keep up with increasing EV adoption.

Track Energy Usage

Smart EV chargers can measure how much energy each charging session uses. This data helps utilities better understand the impact of EVs on the grid so they can make improvements to handle increased future demand. The stats also allow EV owners to see their personal charging usage and costs to identify ways they might be able to charge more efficiently.

Identify and Address Issues Proactively

Continuously monitoring connected EV chargers means any problems can be detected immediately. Station owners are alerted to charger failures, connectivity issues or other malfunctions right away and can dispatch technicians to fix the issues promptly. This minimizes downtime and ensures a good experience for EV drivers. Software and security updates can also be deployed remotely to all connected chargers at once.

Offer New Value-Added Services

The data and connectivity provided by the IIoT opens up opportunities for new services that improve the charging experience. For example, station owners could offer reservation systems so EV drivers can schedule a charging time slot in advance. The stats could also enable dynamic pricing models where rates are adjusted based on the time of day and current grid demand. New partnerships may emerge between utilities, charging networks, automakers and other players in the EV ecosystem.

The IIoT is enabling exciting innovations in EV charging through real-time data collection, monitoring and analysis. With smart chargers, station owners and utilities can gain insights to optimize infrastructure, address problems quickly and create new value-added services for EV drivers. The connectivity allows all parties to work together to build a charging experience that seamlessly integrates EVs onto the grid.

Remote Charging Management and Control

One of the biggest benefits of IIoT connectivity with EV chargers is the ability to remotely monitor and control charging operations. As an EV charger owner or operator, you'll have an easy way to oversee all your charging assets and make adjustments as needed to ensure the best experience for drivers.

Real-Time Data Monitoring

With IIoT, you can access real-time data on the status and usage of each EV charger. See which chargers are currently in use, available, or offline. Check on the current charge level and estimated time remaining for vehicles that are plugged in. Monitor historical usage data to identify trends and usage patterns at each charger location. All this data helps you gain valuable insights into how your EV chargers are performing and being utilized so you can make informed decisions about future expansions or upgrades.

Remote Control and Adjustments

IIoT connectivity also allows you to remotely control and adjust EV chargers as needed. If a charger goes offline or stops functioning properly, you can often reboot it remotely to restore service. You can also temporarily boost the power level or adjust charge times for certain chargers based on current demand. These remote controls and adjustments help ensure maximum uptime and optimal functionality of all your EV charging assets.

Software Updates

With IIoT, EV charger software and firmware updates can be deployed remotely over the air. There are no need to send a technician out to each charger location to manually update the systems. Software updates allow you to enable new features, patch security vulnerabilities, fix any bugs, and keep charger software up to date with the latest standards. Regular updates help future-proof your EV charging infrastructure.

Overall, IIoT connectivity and remote management capabilities are revolutionizing the EV charging experience for both station owners and drivers. The ability to monitor data in real time, control and adjust chargers remotely, and deploy over-the-air updates is transforming EV charging into an efficient, optimized, and intelligent system.





Enhanced Charging Station Reliability and Uptime

When it comes to EV charging stations, reliability and uptime are crucial. Nothing is more frustrating for drivers than pulling up to a charger that isn't functioning properly. Thanks to IIoT connectivity, EV charging stations can now be closely monitored and managed remotely to maximize availability.

Proactive Monitoring

With IIoT technology, EV charging stations are connected in real-time, allowing operators to monitor the status and health of each charger 24/7. They can detect anomalies immediately and often fix issues remotely to avoid downtime. For example, if a charger goes offline, the operator will receive an alert right away and can restart the unit or reboot its software to get it back up and running. They can also monitor usage and error logs to identify any patterns that may indicate a need for maintenance or repairs before the charger fails completely.

Software and Firmware Updates

Another benefit of IIoT connectivity is the ability to deploy over-the-air software and firmware updates. Operators can remotely update the software that powers the chargers to implement enhancements, apply security patches, or fix any bugs. They can also update the firmware that controls the physical charger components if needed. These updates help ensure the systems are running optimally and securely at all times.

Proactive Maintenance

With constant monitoring and data analysis, operators can take a proactive approach to maintenance for maximum uptime. They can schedule routine maintenance or repairs based on usage levels for specific components before issues arise. They can also spot trends that indicate a charger may need servicing soon and dispatch a technician to perform inspections or swap out parts. Proactive and predictive maintenance enabled by IIoT connectivity helps minimize both planned and unplanned downtime.

In summary, IIoT-connected EV charging stations provide operators with the visibility and control they need to keep stations up and running as much as possible. Enhanced monitoring, over-the-air updates, and predictive maintenance all contribute to maximizing the availability and reliability of charging infrastructure. For EV drivers, that means more dependable access to the power they need to keep their vehicles on the road.

Improved Load Balancing and Grid Integration

The adoption of IIoT connectivity in EV charging infrastructure is enabling improved load balancing and integration with the power grid. As more EVs hit the road, the massive spikes in energy demand as drivers plug in risk overloading the grid. Smart charging helps address this by shifting the timing of charging or modulating the power draw.

Balancing the Load

By connecting EV chargers to the IIoT, operators can monitor charging patterns and energy usage in real-time. They can then adjust charging rates based on the current load and capacity, ramping down power delivery during peak demand periods. This helps avoid blackouts and brownouts from overloaded transformers. It also allows more EVs to charge at the same time without maxing out the grid.

Vehicle-to-Grid (V2G) Integration

IIoT-enabled EV chargers open up the possibility of vehicle-to-grid integration. This allows energy stored in EV batteries to be fed back to the grid when needed. For example, if there is a spike in demand that threatens to overload the system, connected EVs can discharge power to help meet the demand and stabilize the grid. This gives grid operators access to a distributed network of energy storage in the form of EV batteries.

Optimized for Renewables

Smart EV charging is well-suited to support increased renewable energy on the grid. The timing of charging can be dynamically matched to the availability of solar and wind power, soaking up excess generation during peak renewable output periods. EV batteries also provide storage capacity to hold renewable energy for use when the sun isn't shining or wind isn't blowing. With V2G, EVs can discharge power from their batteries back to the grid to help fill gaps when renewable generation dips.

IIoT-based load balancing and grid integration significantly improve the sustainability and resilience of EV charging infrastructure. By managing energy usage intelligently based on capacity and demand, more EVs can be supported without overtaxing the grid. And with V2G, EVs become an asset that enhances stability and optimizes the use of renewable power. The future of smart, sustainable transportation is electrifying!



New EV Charging Applications and Services

New EV charging capabilities are emerging that provide more connectivity and control. With IIoT integration, EV charging station owners and operators now have options to optimize costs, improve the customer experience, and open up new revenue streams.

Smart Charging

Smart charging uses software and connectivity to schedule and control when and how EVs charge. Station owners can shift loads to off-peak times when energy is cheaper, easing stress on the grid. For EV drivers, smart charging means paying lower rates. Some utilities even offer rebates and incentives for participating in these demand response programs.

EV Charging as a Service

Some companies now offer e-charging as a services models where the charging equipment and installation are provided at little to no upfront cost to the site host. The charging service provider maintains the equipment and shares a portion of the charging revenue with the site host. This can be an easy way for businesses to offer charging without a big investment.

New Payment Models

In addition to paying by the kilowatt-hour, new options are emerging like subscription-based plans for unlimited charging at a monthly flat rate. For destination charging at hotels, restaurants and entertainment venues, free charging can be offered to attract customers and build goodwill. Loyalty programs can also reward frequent charging station users.

Ancillary Services

EV charging stations provide an opportunity for additional services. Things like:

- Advertising space for local businesses
- Product placement and coupons on charging station screens
- Package delivery lockers for drivers to access while charging
- Coffee, snacks, Wi-Fi and lounge areas at charging hubs

EV charging is evolving into a service that can enhance the customer experience, open up new business models, and provide additional value to site hosts and utilities. Connectivity and software are enabling innovative applications that make EV charging smarter, more useful and even fun. The future of electric vehicle fueling looks bright!





Case Studies of IIoT Implementation

The IIoT is enabling new capabilities for EV charging that provide benefits for both charging station owners and EV drivers. Here are a few case studies showing how IIoT connectivity is revolutionizing the EV charging experience:

ChargePoint

ChargePoint operates one of the world's largest EV charging networks. They use IIoT connectivity to provide station owners with real-time data on usage, costs, and status. This helps owners optimize pricing and make data-driven decisions about expanding or improving their charging network. For drivers, the ChargePoint app shows real-time availability and status updates for stations so they can find an open charger and start a session easily.

EVgo

EVgo uses IIoT technology to enable "plug and charge" capabilities at their charging stations. Registered EVgo members can simply plug in their vehicle without swiping a card or using an app to start a charging session. The station recognizes the vehicle and automatically starts the charging process, deducting the cost from the driver's account. This provides a convenient, frictionless experience for frequent EVgo customers.

ABB

ABB is a leading supplier of EV charging hardware and software solutions. Their Terra HP charging stations use IIoT connectivity to enable smart charging features like load balancing and demand response. These features allow charging station owners to adjust charging speeds across multiple ports based on the available power supply. This helps prevent overloading the power grid during peak demand periods. For drivers, the ABB app provides real-time updates on charging port availability and wait times so they can find the fastest, most convenient place to charge their EV.

The case studies show how IIoT-enabled smart charging delivers benefits through software features and connectivity between charging stations, vehicles, station owners, power grids, and drivers. As more charging networks adopt advanced IIoT technology, the EV charging experience will become faster, more convenient, and efficient. The future of electric mobility is connected.

The Future of Connected Electric Vehicle Charging - FAQs

The future of connected electric vehicle charging is exciting. As more EVs hit the road, smart charging will be crucial to managing the increased demand on the grid. Here are some frequently asked questions about what the future may hold for connected EV charging:

How will smart charging impact the grid?

Smart charging, enabled by IIoT connectivity, allows EV chargers to communicate with the utility grid. This means chargers can optimize the time and rate of charging based on factors like energy prices, renewable energy availability and grid capacity. By charging at off-peak times or slowing the charge rate during peak demand, smart chargers can help stabilize the grid.

What role will renewable energy play?

Renewable energy and EVs are a perfect match. Connected chargers will be able to tap into on-site solar or wind energy generation to charge EVs with clean power. When renewable energy is abundant, chargers can maximize charging rates. They can also store excess solar or wind energy in EV batteries to use later. This symbiotic relationship helps further reduce emissions and takes pressure off the grid.

How will pricing models change?

With smart charging, EV owners will have more choices in how they pay for charging and can save money. Time-of-use rates that are higher during peak daytime hours and lower at night will encourage off-peak charging. Real-time pricing based on fluctuating wholesale energy rates may pass savings on to customers when rates are low. Subscription models for unlimited charging at a fixed monthly rate may also emerge.

What impact will connectivity have on public charging?

Public charging will become a seamless experience. Apps will locate chargers, check availability and pricing, and start a charging session. Integrated payment will allow easy billing to a credit card on file. Notifications will alert drivers when charging is complete or if a charger becomes available sooner. Plug-and-charge technology will enable drivers to simply plug in their EV without any app or card required for authentication.

The future of EV charging looks bright with the rise of connectivity. While it's difficult to predict exactly what's to come, more choices, lower costs, less hassle and a greener grid seem likely. The road ahead for connected electric vehicle charging should lead to greater adoption of EVs and a more sustainable transportation system.

Conclusion

So there you have it, a glimpse into how IIoT connectivity is revolutionizing the world of electric vehicle charging. The future is bright for smarter, faster, and more efficient EV charging thanks to advancements in IIoT technology and infrastructure. As charging stations get through IIoT connectivity, the overall EV charging experience will become more seamless and convenient for you. The day where you can simply drive up and plug in at any charging station, letting the IIoT systems handle the payment, usage data, and grid optimization automatically, is not far off. The road ahead is an exciting one, so buckle up - the future of EV charging is going to be quite a ride!