

ELECTRIC VEHICLE CHARGING SOLUTIONS FOR FLEETS

Plug-in electric vehicles or EVs are ideal for fleet managers for numerous reasons: they are more energy efficient; they are less costly to operate and require fewer resources to maintain. In addition, adding EVs can significantly lower a fleet manager's total operational costs, and help meet government regulations for Alternative Fuel Vehicle (AFV) acquisition, fuel efficiency and greenhouse gas (GHG) reduction.

Senior J.D. Power analyst Dave Sargent recently stated that the demand from corporations for electric vehicles in their fleet could help kick-start the market for electric fuel. In preparation, companies like General Electric, which operates one of the world's largest motor vehicle fleets, are investing in EV, and over the next several years plans to convert half of its vehicle fleet to battery power.¹

However, no matter how eager fleet managers may be to introduce EVs into their fleet inventory, they must face new challenges associated with providing the necessary charging infrastructure to deliver electric fuel to those new vehicles, reliably and cost-effectively while meeting government regulations.

This paper examines the key challenges that fleet managers face and demonstrates how Coulomb Technologies ChargePoint® networked electric vehicle charging solutions address those challenges with innovations in EV fleet management and networked charging stations.

What is the ChargePoint® Network?

The ChargePoint networked EV charging stations are managed by the ChargePoint Network and provide EV drivers the ability to locate and navigate to charging stations from any smart phone and the ability to detect charging station availability from a smart phone or Google Maps. The ChargePoint Network also facilitates EV trip mapping, driver billing, 24/7 driver assistance, and greenhouse gas and energy savings (kWh) measurement.

The charging stations have dual outputs that deliver energy simultaneously: a 7.2 kW output delivering Level II (208/240 VAC @ 30 A) charging via the standard SAE J1772™ connector and fixed 18-foot cable, and a 2 kW output delivering Level I (120 VAC @ 16 A) charging via a standard NEMA 5-20 receptacle protected behind a locking door.

Coulomb Technologies' ChargePoint Network is a complete EV charging solution that includes application services and charging stations. The ChargePoint Network is ideal for fleet managers who:

- Need to track and report EV charging data.
- Need to ensure driver safety at all times.
- Want to plan for future business growth.
- Have to ensure EVs in the fleet are charging or fully charged when needed.
- Must provide public access to electric fuel outside of their depot.

The ChargePoint application services provide Web-based portals for Hosts (station owners) and fleet managers. Fleet managers have strict requirements for vehicle range and readiness, charging station access, driver safety and cost controls, all that require a flexible, centrally managed charging solution. Fleet drivers need convenient access to charging stations as well as the ability to track charging status and costs at all times. With an open, high-reliable charging solution, and the option to offset electricity,

¹ "Fleets likely to drive early demand for electric cars," by Paul A. Eisenstein, <http://www.msnbc.msn.com>, December 1, 2010.

capital equipment and maintenance costs by collecting charging access fees from public drivers, the ChargePoint Network provides the tools to effortlessly track fleet statistics and keep operation costs down.

The ChargePoint Network charging stations are in constant communication with the ChargePoint Network Operating System (CPNOS) using a combination of standards-based protocols and wide area communications technologies. Charging stations are grouped together into radio groups that communicate locally with one another using 2.4GHz, 802.15.4, full mesh radio protocol. Each radio group has a charging station, called a gateway charging station, which is equipped with a cellular modem. Communications with the CPNOS occur through the gateway charging station that has the option to communicate with either CDMA or GPRS. This enables on-demand web-accessed applications for access control, billing, advertising, remote diagnostics, demand side management, station map locations, station-trip-mapping and more.

The charging stations feature open standards to create a consistent, familiar experience for drivers using the ChargePoint Network to obtain electric fuel. Implementing standards-based connectors such as the SAE J1772™ Level II connector ensure drivers can easily plug-in and fuel their electric vehicle with any ChargePoint charging station. The stations' integrated RFID reader supports ISO 15693, ISO 14443, MiFare, contactless credit cards, and ChargePass™ card enabling drivers to activate charging sessions anywhere in the world.

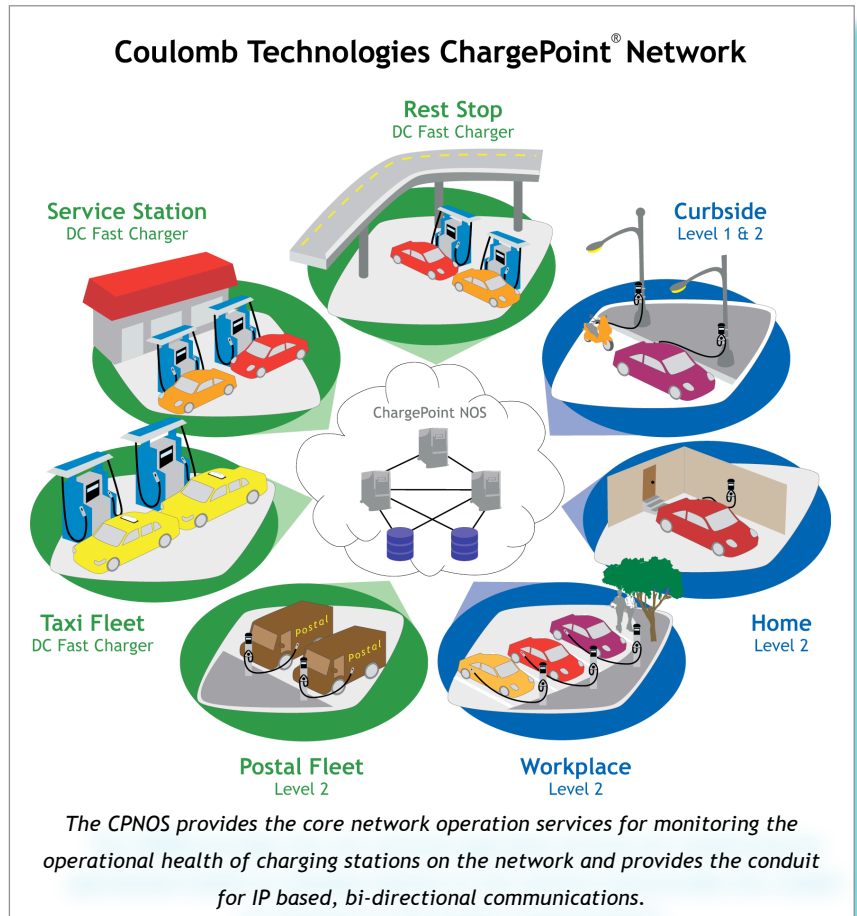
The ChargePoint Network's IP-based protocols and standard interfaces allow the network to easily scale and integrate with existing business systems. Published, open XML API interfaces to the CPNOS provide seamless integration into a company's office systems or a utility's AMI systems. The network also provides opportunities for custom applications and new businesses. For example, charging station location and availability information can be used in custom mobile phone applications and more.

ChargePoint Network and Clean Fleets

The following sections demonstrate how the ChargePoint Network addresses the primary challenges of today's fleet managers.

VEHICLE RANGE

Vehicle range is particularly important to address when managing a fleet of EVs. Although early electric vehicles—which range from 40 to 100 miles between charges—are adequate for many fleet applications, sometimes drivers must have access to charging stations outside the fleet depot. Until recently, there was a lack of convenient access to stations while on the road.



A Web-based ChargePoint Network Driver Portal and iPhone and Blackberry smart phone apps help drivers locate all available ChargePoint stations along their driving route and even provide turn-by-turn directions to that station. The ChargePoint Network enables drivers to access ChargePoint stations located in most metropolitan areas by simply using a major contactless credit card, 24/7 toll free telephone call and ChargePass RFID card to fuel up.

AVAILABILITY OF CHARGING STATIONS

As more electric vehicles enter the marketplace, the demand for charging stations will increase. To keep control over electricity costs and to assure availability of the fleet’s charging stations, fleet managers will need to control access to their stations. The ChargePoint Network provides central control and enables fleet managers to restrict access to authorized users. Alternatively, fleet managers can open station access to the public to defray some of the operational costs incurred by the stations.

Summary		
	Charging	1
	Fault	1
	Charged	0
	Not Plugged In	1

Status	License Number	Driver Name
		San Francisco Driver
		ZipCar Driver
		City CarShare Driver

VEHICLE READINESS

Companies and agencies that deploy fleets have high-reliability expectations for their EVs, and fleet maintenance teams must ensure their EVs are always fully charged and ready to go. ChargePoint Fleet Manager provides insight to the charging status of every EV in the fleet, at all times. The application sends fleet managers automated alerts via email or text message with a detailed summary of charging status. A mapping feature provides easy-to-read car symbols indicating where vehicles are charging, with color-coding to indicate whether the vehicle is fully charged, charging or not plugged in.

Fleet managers can filter and export inventory and usage reports from ChargePoint Fleet Manager to other applications for asset tracking and usage trend analysis. By improving and simplifying fleet management, the ChargePoint Network helps fleet managers track vehicle readiness and be better prepared to meet business demands.

TRACKING COSTS AND ENERGY SAVINGS

To ensure the efficiency and productivity of a clean fleet, it is critical to accurately track costs, energy usage, GHG emissions and fuel savings. Metrics that reflect energy and cost savings help to illuminate the benefits of maintaining a clean fleet. ChargePoint Fleet Manager tracks and monitors electricity usage, charging sessions, start and stop times, and the duration of charging sessions at

any ChargePoint Network station. Fleet managers can export this data and import into other applications for easy cost and energy savings analysis.

The ChargePoint Fleet Manager also helps eliminate energy theft by tracking how charging stations are accessed. Fleet managers can set station access options for public or private use, customize ChargePass RFID card restrictions by individuals or groups, and configure availability by day of the week or time of day.

ENSURING DRIVER SAFETY

Fleet managers must make certain their drivers are as safe as possible at all times to limit legal liability to the business. The ChargePoint Network ensures charging stations will energize only if they're in good working order, and users are safely

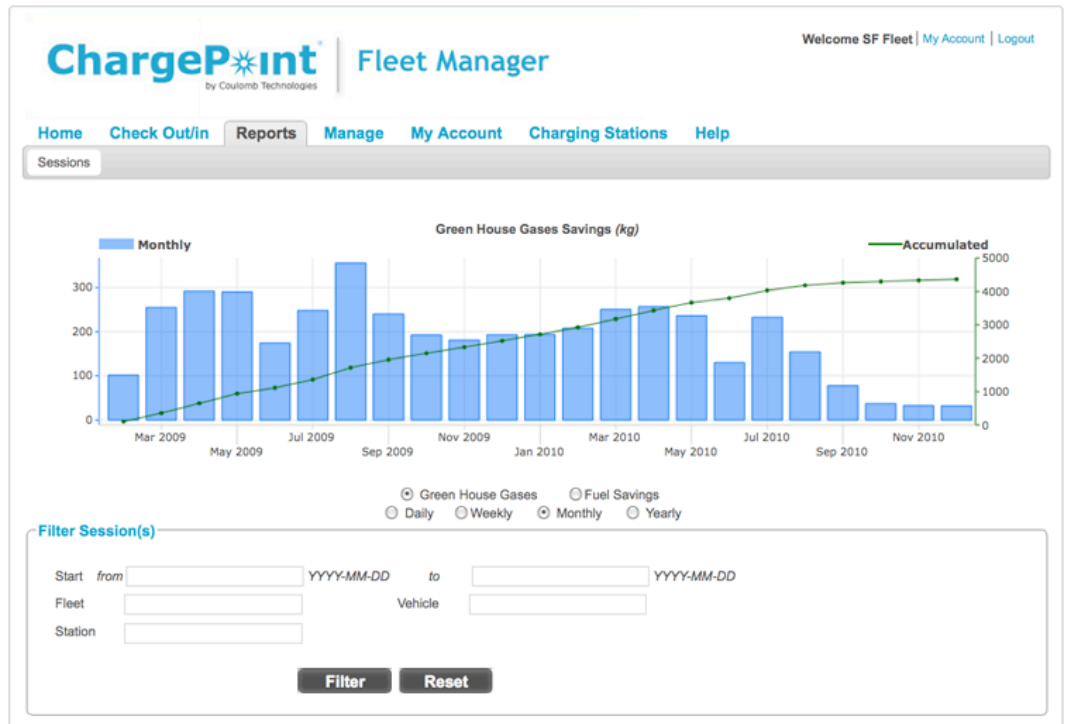
isolated from the electricity until access to the station is authorized over the network. Fleet managers can quickly detect maintenance issues that arise from vandalism, misuse or normal wear and tear, or choose to be notified automatically before maintenance issues escalate to safety or reliability problems.

Using automated alarms and the Web-based Service Manager interface, fleet managers can access, manage and diagnose thousands of charging stations from a single location, ensuring maintenance staff is deployed only when necessary, reducing costs and preserving resources. Additionally, fleet managers can use Service Manager to store all provisioning information and automatically reprogram replacement hardware in minutes, with just a few clicks. Service Manager can be configured to automatically send out SMS and email notifications when problems occur or when new Station Manager accounts are created. Fleet managers can filter or export history to other software applications for easy analysis of alarm trends. They can also use the interface to annotate and clear alarms once they've been addressed.

UTILITY SMART GRID COMPATIBILITY

With the time-variable nature of renewable energy sources and with anticipated increase in electrical demand, utility companies are implementing smart grid capabilities to ensure reliable energy delivery during peak load times within their service area. As smart grid capabilities evolve, utility companies may require charging systems that are smart grid enabled. They may also offer rate incentives for smart grid compatibility.

Designed with the smart grid in mind, the ChargePoint Network helps you save money with utility programs and incentives by leveraging utility pricing, ensuring compatibility with an electric utility's AMI. ChargePoint stations feature utility-grade meters and the demonstrated ability to communicate bi-directionally with other Smart Grid systems allow for demand response, TOU pricing, and other smart grid programs provided by the utility.



With the Fleet Manager software service, fleet managers can track and monitor vehicle usage data by charging session, start and stop times, charge duration, electricity used, and driver to vehicle integration. This data can be exported and combined with data from other systems to track costs, calculate savings and monitor efficiencies of the electric vehicle charging system.

PLANNING FOR RAPID CHANGES AND FUTURE GROWTH

The electric vehicle market is undergoing rapid change and growth. Within five years there will be millions of electric vehicles with new capabilities. ChargePoint Networked Charging Stations provide Levels I, II and DC Fast Charging to accommodate the broad range of EV that will be introduced to market in the coming years. Additionally, with centralized remote management through the Fleet Manager software service, companies can scale their fleets to accommodate growth by deploying and managing thousands of stations through a single interface. Customizable portals provide detailed charging data that can be organized and exported for analysis and reporting. Remote upgrades over the ChargePoint Network enable fleet managers to keep charging stations updated and in optimal working order. With these features, ChargePoint Fleet Manager simplifies EV fleet management to enable rapid scalability and the flexibility to accommodate changing business needs.

CHARGEPOINT NETWORK IN ACTION: COUNTY OF SONOMA

In July 2009 three-phased plan to deploy a charging infrastructure was launched by the County of Sonoma in California, to support its growing use of EV as county vehicles. Seven ChargePoint Networked Charging Stations were purchased from Coulomb Technologies, and installed by Sonoma County Facilities Operations staff at six county locations, bringing the county closer to reaching its long-term goal of establishing a viable public infrastructure for EV charging. Currently, the county has 15 active charging stations and is in the process of installing nine more. Ultimately, the county plans to provide access to 50 EV and 80 ChargePoint Networked charging stations.

Through its Fleet Manager software service, the ChargePoint Network makes it easy for the County of Sonoma's fleet operations division to ensure vehicle readiness, manage EV fleet charging and easily report petroleum fuel and GHG reduction to meet government regulatory requirements for AFV acquisition. Fleet Manager gathers metrics over the network, such as charging status and driver behavior, and generates easy-to-understand reports that help justify the use of EVs as a way to reduce costs, gasoline usage and GHG emissions. This is important, because the County of Sonoma has strict requirements for climate protection.

According to David Head, fleet manager for the County of Sonoma Fleet Operations Division, "ChargePoint Network Fleet Manager makes it easy to organize and report on the data that shows how we're doing our part, in a way that the County authorities can understand."

Conclusion

The ChargePoint Network and its Fleet Manager software services make it easy for fleet managers to ensure vehicle readiness, manage EV fleet charging, and report on and analyze petroleum fuel and GHG reduction. Together, the solutions provide networking, the utility grid, electric vehicles and businesses with efficient charging station management, and ensure drivers always have available stations. Coulomb's billing system allows owners of charging stations (hosts) to require drivers to pay for the use of their stations, thereby compensating hosts for costs associated with electricity usage, maintenance and capital. Additionally, Coulomb's network of charging stations are maintained and monitored remotely with market-leading management applications, which reduces maintenance and upgrade costs, improves time to repair when there are problems, and increases driver safety.

With built-in support for Level I, II and DC Fast Charging stations, ChargePoint is scalable and flexible enough to accommodate today and tomorrow's needs as businesses expand and diversify their fleets.

WHAT CAN THE CHARGEPOINT NETWORK HELP YOU DO?

- Meet government regulatory requirements for AFV acquisition, petroleum fuel and GHG reduction.
- Provide electric fuel to all EV brands regardless of charging level.
- Ensure vehicle readiness by confirming electric fuel delivery.
- Track EV charging in and outside of the depot.
- Track and report on gasoline and GHG emissions reductions.
- Track activity of EV fleet users.
- Track and report the amount of electricity that is used for fleet transportation.
- Lower fleet operational costs.
- Restrict station access, charge for public use.

About Coulomb Technologies, Inc.

Coulomb Technologies is the leader in electric vehicle charging solutions, with charging systems and application services delivered by the [ChargePoint Network](#). The ChargePoint Network provides multiple web-based portals for Hosts, Fleet Managers, Drivers, and Utilities. The open-system driver network went live in January 2009 and now operates in 14 countries with Network Operations Centers in the U.S., UK, Ireland, the Netherlands, Germany and Hong Kong. Coulomb's [ChargePoint Networked Charging Stations](#) range from 120 to 240 VAC charging up to 500 Volt DC fast charging with over 2500 stations shipped worldwide.

- For more information go to: www.coulombtech.com.
- Follow Coulomb on Twitter: twitter.com/coulombevi.
- Download the [ChargePoint iPhone App](#).

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