Smart Charging: The Key to Unlocking Revenue Opportunities for M/HD EV Fleets

November 12, 2020
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Smart Charging for Medium/Heavy Duty (M/HD) Electric Vehicle (EV) Fleets

Rick Sander, CEO
Joseph Gottlieb, CTO
Rhombus Energy Solutions
www.rhombusenergy.com
Who is Rhombus Energy Solutions?

• Rhombus is an industry leader in advanced power conversion, providing solutions to:
  - AC-DC Systems for Transportation Electrification
  - Energy Storage Systems For Charging Support / Power Load Leveling
  - Microgrids, w/ Integrated Command / Control energy management

• Rhombus is headquartered in San Diego with a high-power testing lab and manufacturing in Dearborn as well as a India design center.

• Our expertise is developing bidirectional high-power inverters for renewables, energy storage and microgrids… enabling V2G charging

• Our products are easily customized for specific EV OEMs and fleet requirements

• Rhombus has deployed over 820 systems worldwide

Rhombus is the expert in V2G charging systems for EV fleets
What is a “Smart Charger”? 

- A smart charger/dispenser pair contains enough processing capability to:
  - Talk to the vehicle, gathers vehicle data
  - Contains a database capability to characterize and sort the stored data
  - Interface with upstream systems, software, and components
  - Perform self-diagnosis on its own systems
- Optimally, a “smart charger” has the resources to run new applications
  - Whether from manufacturer or third parties
Why Are Smart Chargers “Hard”?

• Smart chargers must have multiple communication paths
  • Measuring, Monitoring, and Metering requirements for demand energy or behind the meter factory demands
  • Advanced electric vehicle communication link (ISO15118)
  • Aggregator platform, back-end service provider connections

• Smart chargers must meet a significant number of certifications
  • UL 1741-SA, IEEE1547, UL 2202, UL 2231, UL 9741, etc.

• Smart chargers must be designed for both today’s requirements and those of the future
Smart Charger Example Use Cases

• Vehicle to Grid (V2G) charging operation
  • Interfaces with vehicle, fleet scheduling software, and utility aggregation software

• Integration with energy storage systems
  • Interfaces with vehicle, storage battery management system (BMS), energy management system (EMS) software, and PV solar inverters

• Both use cases reduce fleet energy costs, and increase fleet availability
  • They also require data to be moved from vehicles to external systems
  • AND all this data goes through the charger
Rhombus Smart Charger Family

- Rhombus has smart chargers in multiple power ratings
  - 60kW
  - 125kW
  - 500kW
- Our smart chargers are bi-directional (V2G), with UL 1741SA certification
- Our dispensers can be remoted up to 600 feet away from the power conditioning system
- Our smart chargers are rated for outdoor use in the most demanding conditions
Smart Charging for Medium/Heavy Duty (M/HD) Electric Vehicle (EV) Fleets

Oleg Logvinov, President and CEO
IoTecha
www.iotecha.com
IoTecha is Leading the Paradigm Shift at the Nexus of Transportation Electrification and Power Grid Transformation

IoTecha is accelerating the Electric Vehicle Revolution by providing a comprehensive IoT.ON™ Platform for the Smart Charging infrastructure and enabling the integration of tens of millions of Electric Vehicles with the Power Grid.

IoTecha was launched in 2016 and is already a B2B supplier to many customers in US and EU.

IoTecha is an expert in V2X Smart Charging (V2G, V2H, V2L, ...) and Plug and Charge based on CCS with ISO/IEC 15118
IoTecha’s Products and Services

- Root-CA Ecosystem
- IoT.ON™ Cloud
- IoT.ON™ Edge
- V2G Protocol Analyzer
- EV Module
- AC or DC

IoT.ON™ Cloud
AC EVSE
AC and DC EVSE Modules
Root-CA Ecosystem
V2G Protocol Analyzer
EV Module
AC or DC
• ELITEGROUP LIVA 19.2 kW (80A) AC Charger powered by IoTecha’s IoT.ON™ technology
• Combined Charging System with ISO/IEC 15118 (V2G and PnC)
• OCPP 1.6J+
• IoT.ON™ Cloud Services
• RFID
• Cellular, WiFi, and Ethernet connectivity
V2X Use Cases and Benefits

Consumers
- Charge at work using the lowest price
- An opportunity to earn money charging and discharging at work

Fleet Operators
- OpeEx reduction through the fleet operation optimization
- Smart Charging based on the EV's State of Charge
- Grid Services based on V1X and V2X capabilities

Employers
- Provide value to employees
- Green their businesses
- Offset energy costs by allowing employees to charge and discharge based on the ToU

Energy Companies
- Grid Services based on V1X and V2X capabilities
- Attract customers by offering incentives based on participation in Grid Services

Automotive OEMs
- Reduction of the EVs TCO through the participation in Grid Services
- Attractive consumer offering
Monetization of the VGI Opportunity

By 2030, the US market for services to support the charging of electric-vehicle fleets could be worth $15 billion


A V2X capable vehicle can generate over $5,000 per year while charging at work in Newark, CA

Source: https://www.iotecha.com/v2x-is-a-game-changer-for-the-tco-of-evs/
DC and AC Architectures
VGI Scenarios

- Alexa, Google, Apple, Samsung, ...
- SEP2.0, EEBus, TiC, Echonet, ...
- OpenADR, MQTT, ...

CCS (ISO/IEC 15118)

Economy of Scale + Adaptability and Flexibility

Smart Home & Home Automation

VGI

HEMS

Grid
A DC Charger based on IoTecha’s CCSoM Module

- Control Application
- ISO/IEC 15118 V2G Communications
  - Authorization (including PnC)
  - Charging telemetry exchange
  - IoT.ON™ Cloud communication
  - GUI / Smartphone app interface
  - OCPP 1.6J
  - Sensor data aggregation

- Control Pilot PWM Generation
- Automatic CP disable
- Safety controller
- Control of Rectifier
- Data to/from V2G Comms
- Monitoring of Rectifier

CCSoM – based Dispenser

- WiFi, Cellular, Etc.

IMD - Isolation Monitoring Device
Panel Questions and Audience Surveys
Panel Question #1

• How critical are smart chargers to use cases like V2G or integration with stationary energy storage resources?
  • Rick Sander (Rhombus)
  • Joseph Gottlieb (Rhombus)
  • Oleg Logvinov (IoTecha)
  • Michael Macaluso (IoTecha)
Panel Question #2

• When charging M/HD EV fleets, what are the major concerns that fleet operators should look for when selecting a charger solution?
  • Oleg Logvinov (IoTecha)
  • Michael Macaluso (IoTecha)
  • Rick Sander (Rhombus)
  • Joseph Gottlieb (Rhombus)
Panel Question #3

• How important is it for smart chargers to be able to run 3rd party applications?
  • Joseph Gottlieb (Rhombus)
  • Michael Macaluso (IoTecha)
  • Oleg Logvinov (IoTecha)
  • Rick Sander (Rhombus)
Want More Information on Smart Charging for M/HD EV Fleets?

• Rhombus: news@rhombusenergy.com
• IoTecha: sales@IoTecha.com
The Attraction of Vehicle To Grid (V2G)

- V2G is an incredibly smart idea for EV fleets
  - Helps to stabilize the grid during peak demand hours
  - Offsets intermittent renewable power resource
  - Provides a source of emergency backup power
  - **V2G can significantly reduce EV fleet energy costs**

- Why has V2G not been readily available until now?
  - V2G is not new (it originated at UoD in 1997), but it is complicated (lots of elements to the system)
  - EV are becoming popular (greater range, lower cost)
  - Utility rate plans are now supporting V2G economics

- V2G gaining traction with fleets as the arbitrage economics are proven out.
Why Are V2G Implementations Challenging?

- There are many participants in V2G operation:
  - EV Owner
  - EV OEM
  - EVSE OEM
  - Software Aggregator
  - Grid operators / utilities
    - Utility DSO (Distribution System Operator)
    - Utility TSO (Transmission System Operator)
  - “Standards” groups.

- These groups and industries must work and communicate with one another other for V2G be truly successful.
How Do We Accelerate Vehicle To Grid?

- To gain wide scale commercialization, we need improved (and ideally simplified) industry standards:
  - Grid communication
  - Grid Interconnect (for bi-directional power flow)
  - EV to charger communication
  - EV charger standards
  - Aggregator software/service providers
  - Safety and Security
- In the interim, large fleet deployments will drive forward using semi-custom installations while trying to “future proof”
“Smart” bidirectional charger provides the gateway to the utility grid connection

- The charger system controls power flow and direction while and communicates to aggregator, grid and EV user.

- V2G chargers must have multiple communication paths
  - Measuring, Monitoring, and Metering requirements for demand energy or behind the meter factory demands
  - Advanced electric vehicle communication link (ISO15118)
  - Aggregator platform and back-end service provider connections

- V2G chargers must meet a significant number of certification standards
  - Eg: UL 1741-SA, IEEE1547, UL 2202, UL 2231, UL 9741…

Other Requirements:

- Industrial rated design to reliably operate at full power continuously day and night
- Easily maintained and serviced if problems occur.
- Remote diagnostics/prognostics to reduce downtime and prevent issues before they happen.