PHEV charging for the real world

PHEV2007
Winnipeg, MB
Presentation Points

Delta-Q’s perspective

Fleet Charging Overview

PHEV Basics

PHEV Roadmap
## Delta-Q Perspective

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200,000 chargers fielded since 2003

**Delta-Q’s Entry Point:** “Displace line frequency off-board chargers in mature markets with high frequency onboard chargers”

**In-House Product Design and Development**

**Sales, Marketing and Customer Service from Head Office**
Delta-Q has focused on these critical design principles in the creation of all of our products:

- Efficiency
- Power Factor Correction
- Sealed construction
- Reliability
- Space
- Weight
- Parts Count
- Thermal Efficiency
- Cabling
- Integration
- Maintenance
- Ease of Use
- Total Cost of Ownership
Product Applications
Battery Charging Solutions

Off-board chargers in fleet application
Battery Charging Solutions

Early on-board application
~1000W, 24V, 36V, 48V, 72, 96V Universal I/P, .99 PF, CSA/UL/CE
Sealed construction, high efficiency
Replacement charger for Ford
THINK Neighbour
Charger for DaimlerChrysler GEM NEV

400W 12V isolated DC-DC
Battery eliminator for high performance applications with 12V accessory loads

~750W 36V, 48V charger
DSP controlled, very high reliability, sealed construction, high efficiency
Onboard application using Delta-Q HF charger
Plug-in Hybrids

- Aftermarket Integrators:
  Example: EnergyCS of California
- Universities:
  Example: University of California-Davis
- Automotive OEMs:
  TBA - in discussions

Delta-Q Product Development Direction

- Driven by OEM requirements
- Higher voltage (300+ VDC output)
- Higher power (2-6kW)
14V system required for vehicle systems (i.e. lights, radio, etc.)
High voltage propulsion pack (>250V)
Parasitic losses on vehicle need to be extremely low
Advanced batteries require monitoring/control during charge
Weight and bulk added for charging will reduce available space and carrying capacity
Efficiency is critical - overnight charging in residential setting (i.e. 120VAC) can only replenish 3 miles or 5km per hour of charge (@~300Wh/mile)
Immunity and emissions must comply with residential standards
Chargers must integrate perfectly into vehicle AND grid/utility
PHEV batteries are “not ready” for prime time (performance, cost, reliability, etc.)
Different use patterns require different charge rates (i.e. commuter - 1kW, work truck fleet - 6kW)
Forward compatibility with potential future requirements is desirable
This is an automotive part - cost and reliability are important
PHEV must be easy to use!
PHEV Charging Phase I

QuíQ™ & EnergyCS™

- ~1000W, 250V
- Universal I/P, .99 PF
- Sealed construction, high efficiency

- Li (Valence) batteries

EnergyCS introduces Plug-in Prius at EVS21 in Monaco
High Voltage DC Output

- DC Output Voltage - range: 200-405 V
- DC Output Current - maximum: 5.0 A
- Battery Type: all
- Reverse Polarity: Optional, up to -450 VDC
- Short Circuit: Electronic current limit

12V DC Power Supply (Optional) 200 W

- Output voltage - nominal: 14 V
- Output current (continuous): 15 A
AC Input

- AC Input Voltage - range: 85-265 VAC
- AC Input Voltage - nominal: 120 VAC
- AC Input Frequency: 45-75Hz
- AC Input Current - maximum: 12 A
- AC Input Current - nominal: 11 A
- Conversion Efficiency - typical: 90%
- AC Power Factor - nominal: >0.95
PHEV Charging Phase II

Mechanical

- Dimensions: 320mm x 130mm x 164mm (12.6" x 5.1" x 6.5")
- Weight: <5kg
- Environmental: IP46
- Operating Temperature: -40°C to +80°C
- Storage Temperature: -40°C to +95°C
- Heat Dissipation: 150W (Conductive / Forced Air / Liquid)
PHEV Charging Phase II

Regulatory

- Safety - Europe: EN 60335-1/2-29
- Emissions - North America: FCC Part 15/ICES 003 Class A
- Emissions - Europe: EN 55011/ EN 61000-3-2 / EN 61000-3-3
- Immunity - Europe: EN 61000-4-2 / 3 / 4 / 5 / 6 / 11
PHEV Charging Phase III

PHEV charging phase II requirements plus:

- Input flexibility to accommodate fleet charging (i.e. 3 Ø AC)
- Output flexibility to accommodate higher pack voltage
- Configuration flexibility to allow charger form factor to fit existing/future vehicle types
Delta-Q PHEV Charger Roadmap

PHEV Charging Phase I (2004 - 07)
  • QuiQ adaptation

PHEV Charging Phase II (2007 - 08)
  • Domestic Unit (15A service)

PHEV Charging Phase III (2008 - 09 and beyond)
  • High Power (Scalable) Unit
    • 1.5kW
    • 3kW
    • 6kW
Summary

OEM-built PHEVs are not a certainty, yet OEM performance requirements are

Speculation is progressive

Delta-Q is actively supporting Auto OEMs and component suppliers with advanced power conversion and power management solutions, with an emphasis on integration
Stuart Evans
Director of Sales
Tel: 604-327-8244 x108
Cell: 778-878-1498
sevans@delta-q.com