New generation of Electrical Vehicle Charging Stations

Delta EMEA Partner Event
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Jorma Autio
1. Introduction
2. Why Electrical Vehicles
3. Electrical Vehicles
4. Electrical Vehicle Charging
5. Delta electrical vehicle charging solutions
6. 3rd generation EV Ultra fast charger
7. Why 120 kW
8. Summary
2015 United Nations Climate Change Conference, COP 21, Paris, France Nov 30 to Dec 11
From 2010 to 2014, Delta’s high energy efficiency of products enabled:

- Electricity Consumption Savings of 14.8 B KWh
- Carbon Emissions Reduction of 7.9 M Tons
Why Electrical Vehicles

Technology
- HEV, PHEV, BEV, AC, DC
- Chademo, CCS
- Battery
- Range

Environment
- Air quality
- Space & Noise
- Global warming
- Health

Need for Transportation

EV User

Change
- Urbanisation
- Limited fossil resources

Cost
- Subsidies
- TCO

Emotions
- Freedom
- Social acceptance

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IHS Automotive forecasts the global EV charging stations installation base to grow to more than 12.7 million in 2020.

The European Parliament will require member states to install a specified number of electric vehicle charging stations by 2020.

Germany will set its target to 86,000, Italy will install 72,000, and the UK is planning to build a minimum of 70,000 EV recharging points.

This directive will help reduce dependence on fossil fuels and achieve a 60% reduction in greenhouse gas emissions from transportation by 2050.
EVs were among the earliest automobiles before powerful internal combustion engines.

Electric automobiles held many vehicle land speed and distance records in the early 1900s.

They were produced by Baker Electric, Columbia Electric, Detroit Electric, and others, and at one point in history out-sold gasoline-powered vehicles.

In fact, in 1900, 28 per cent of the cars on the road in the USA were electric.

EVs were so popular that even President Woodrow Wilson (28. president of US in 1913 – 1921) and his secret service agents toured Washington DC in their Milburn Electrics, which covered 60–70 miles per charge.
..and what’s ongoing in Electric Vehicles

- E Truck
- Opel Ampera, PHEV
- E Bus with on wheel power train
- Delta E Car in Wujiang
- E Bike
- E motorbike in ECarTech
- E-Genius, 405 km; 160 km/h, 900 kg
- Hyundai i35 Fuel Cell Car
Vehicles using both electric motors and internal combustion engines are **hybrid electric vehicles (HEV)** and cannot be externally charged. Toyota Prius; HEV + PHEV; > 7M Toyota HEV + PHEV:s sold.

Hybrid vehicles with batteries that can be charged externally to displace some or all of combustion engine power and gasoline fuel are called **plug-in hybrid electric vehicles (PHEV)**.

A **battery electric vehicle (BEV)** uses chemical energy stored in rechargeable battery packs. BEVs use electric motors and motor controllers. Nissan Leaf; BEV, 195,000 cars sold since Dec 2010 (Oct 2015).
Japanese standard CHAdeMo
The major pioneers of the technology are Japanese automotive OEMs—including Toyota, Nissan, Mitsubishi. French “early birds” (PSA) onboard.

Combined Charging System; (CCS)
Combined charging system (CCS) with a single charging inlet that can be used for all available charging methods. VW, Audi, BMW, Daimler, Chrysler, Ford, GM, Porsche…

Tesla “Superchargers”
Tesla has a third method for fast charging operating at a higher power rating than CHAdeMO or CCS chargers and are free to use for Tesla owners.
Free-standing DC Quick Charger
- CHAdeMO / CCS / 2 * AC charging interface, 50kW – 150 kW DC output, AC 22kW – 43kW (upon configuration)
- Gen 2 available, Gen 3 Q2/2016.
- Full charge in less than 30 minutes for passenger EVs, IEC

Cordset
- Mode 2 AC charging capabilities
- Up to 20A output
- IEC

AC Wall box & Mini
- Rating 200 – 240 VAC /16A
- Wall/Pedestal mounting, fixture available
- 5,5m/18ft charging cable
- SA/GB charging plug or IEC Type 2 socket available

Site Management & Software Solutions
- Real-time monitoring
- Charger configuration
- Remote diagnosis
- Reporting and billing integration
- Energy management

Peak Shaving, Energy Storage and Renewables
- On-grid / off-grid / low-grid with peak shaving, energy storage and RENE
- Focus on total cost of ownership – offering value engineered, cost optimized reliable energy solutions.

Service and Maintenance
- Regional spare part stock
- Regional L2 – service personnel
- Local service and value add support based on Delta own locations
- Regional established and trained service partners
Delta, 3rd generation, Ultrafast Quick Charger

Power up to 120 kW (Housing prepared for 150 kW)
- 2 DC charge points
  - CCS up to 120 kW DC
  - Chademo up to 63 kW (limitation due to actual plug standard; upgradeable to 120 kW)
- 2 AC charge points
  - type 2 plug 43 kW
  - type 2 socket 22 kW

Simultaneous Charging on all 4 outlets (4-in-1)

Configurable Product
- 60 to 120 kW
- 2 to 4 outlets or outlets on both sides
- 2 pcs of CCS outlets or 2 pcs of Chademo outlets
- Configurable power on the 2 DC outlets (60/60, 50/70, 0/120)
- Dynamic power management to minimize charge time
- Configurable grid overload protection
Delta, 3rd generation, Ultrafast Quick Charger

Modular Design
- Scalable power with 10 kW power modules
- Modular building blocks

Software Solution
- Connectivity to various stakeholders
- Supports a variety of payment and access system
- Simple and intuitive to use
- Wireline & wireless connectivity: Ethernet, 3G, GPRS
- Remote software, configuration & whitelist update
- Backend system integration with OCPP (V1.5)
- Local authentication with RFID & whitelist
- Remote authentication & billing managed over OCPP interface
- Integration of smartphone applications
- Integration with roaming service providers

User friendly
Service friendly
Uptime and quality
Total cost of ownership
AC charging
1. Audi: A3 & Q7 e-tron
2. Renault: Zoe & Kangoo (43 kW)
3. VW: GTE & Passat
4. Opel: Ampera
5. Volvo: V60 & XC90
6. BMW: X5, i8
7. Chevrolet: Volt
8. Fisker: Karma
9. Ford: Focus
10. Smart
11. Tesla: model S & X
12. Porsche: Panamera Cayenne, 918 sypder
13. Mercedes: B class
14. Mercedes: S & C class
15. Toyota: Prius

Simultaneous charging of 4 cars in parallel
Connect with own AC cable

AC charging
AC all cars up to 22 kW
1. Kia: Soul EV
2. Nissan: Leaf & e-NV200
3. Mitsubishi i-Miev
4. Citroen: C-Zero
5. Peugeot: iOn

AC all cars up to 43 kW
1. Tesla model S & X (with adapter)
2. Mitsubishi: Outlander

Chademo
CCS:
1. VW: e-Up & e-Golf
2. BMW: i3

Delta Confidential
First installation in Vestby, Norway, Nov 10, 2015

388
Hurtigladesteder
2016-2018
Why 120 kW DC – That’s the future

1. Delta is an OEM Supplier for car industry
2. Range going up to 400 to 500 km:s
3. Increasing capacity of the battery
   longer range and charging time, better packaging of cells
   (Delta Li-Ion batteries)
4. Reduced Charging time
   shorter waiting and queuing time
5. Tesla
   Up to 90 kWh battery, supercharging stations of 135 kW
   Chademo adapter from 50 kW to 75 kW (200 A)
6. Nissan Leaf
   capacity going up from 24 to 30 to 60 kWh
7. Kia Soul
   today 175 A (68 kW)

Conclusions
 More power required
 boost charge power up to 150 kW .. 250 kW
 voltage up to 1000 V DC
Why 120 kW DC – That’s the future

**Chevrolet Bolt** announced for 2017  
CCS; 55 – 60 kWh, range 320 km

**Audi Q6** e-tron, announced for 2018.  
CCS; 92 kWh; range 500 km; Recharge: 50 min (150 kW)

**Audi R8 e-tron** announced for 2016  
CCS; 90.3 kWh; range 450 km; Recharge: 95 min (50 kW)  
(Supports 150 kW)

**Porsche** announced “Mission E concept” for 2018  
CCS; range 500 km; Recharge 5 min with 150 kW / 800 V

**Tesla model-X** announced for end 2015  
60 - 85 kWh; range 365 resp 480 km

**BMW** announced i5 Plug in Hybrid for 2018  
Range 320 km

**Kia**; CCS incr. range  
**Volkswagen, Volvo……...**  
**CCS** – increase charge power
Applications for Battery Energy Storage Solution

Battery Energy Storage Solution

- Solar PV Power
- Wind Power
- Grid

Battery Module

- Function:
  - Renewable energy storage
  - Power stabilization on grid
  - Distributed energy storage

kWh scale Cabinet

- Power scale:
  - Micro Scale: < 10kW
  - Middle Scale: 30-500kW
  - Large Scale: 500kW-1MW+

Industrial/Utility scale up to MWh

- Features:
  - With EMS system
  - High safety standards
  - Long operating life
The solution with peak shaving and energy storage

Power grid
MV/LV Trafo

Site controller

Power meter

80 kW Bi-directional, Modular AC/DC Converter

288 kWh Battery bank

Charging Station
• Battery is charged during nighttime, when electricity tariff is lower
• Battery is discharged during peak-tariff period reducing high-rate power consumption from grid
• Designed and programmed for self consumption
• Different energy charge / discharge scenarios can be programmed on the Site Controller locally or remotely

Delta EMEA Solution Integration Team
Sales.SIT.EMEA@Delta-es.com
Support.SIT.EMEA@Delta-es.com

To learn more about Delta, please visit www.deltawww.com.