New generation of Electrical Vehicle Charging Stations

Delta EMEA Partner Event
December 2015
Jorma Autio

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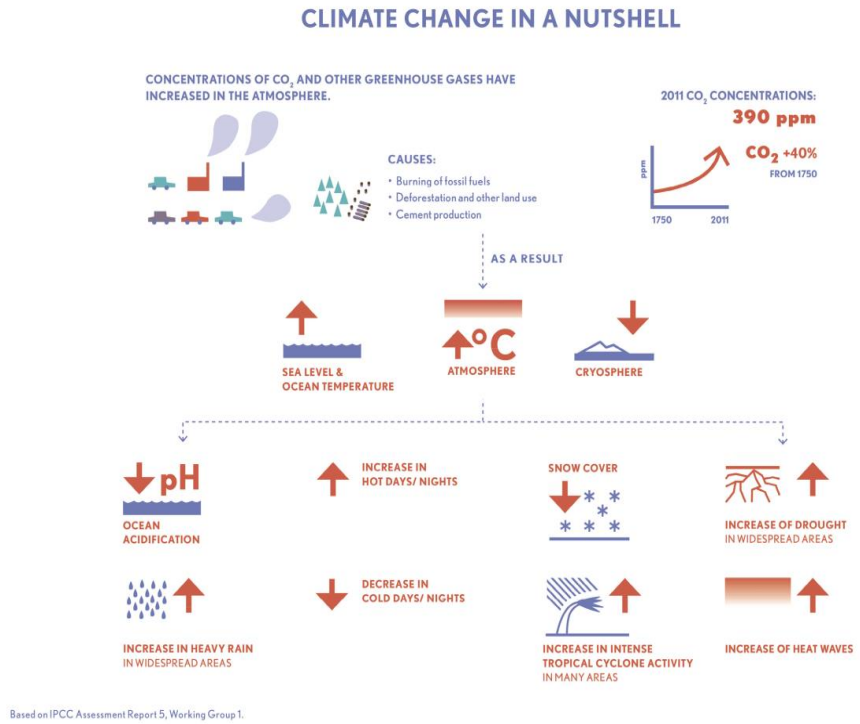
2015 United Nations Climate Change Conference, COP 21, Paris, France Nov 30 to Dec 11



Delta's Contribution to Our Earth

From 2010 to 2014, Delta's high energy efficiency of products enabled:

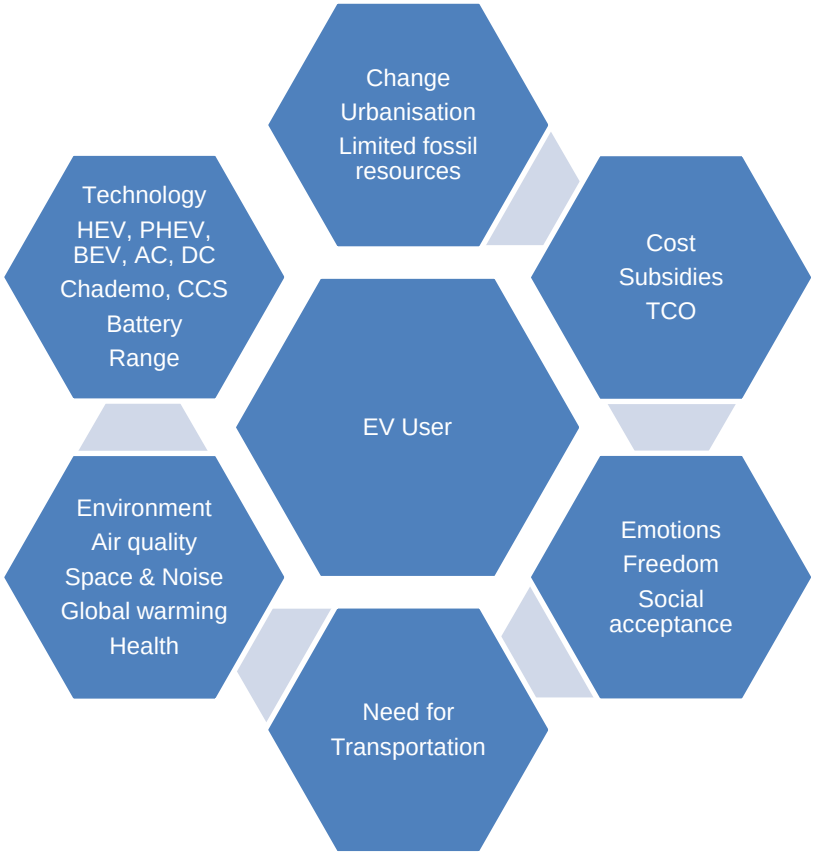
Electricity Consumption Savings

of 14.8 B KWh

Carbon Emissions Reduction

of 7.9 M Tons

Why Electrical Vehicles



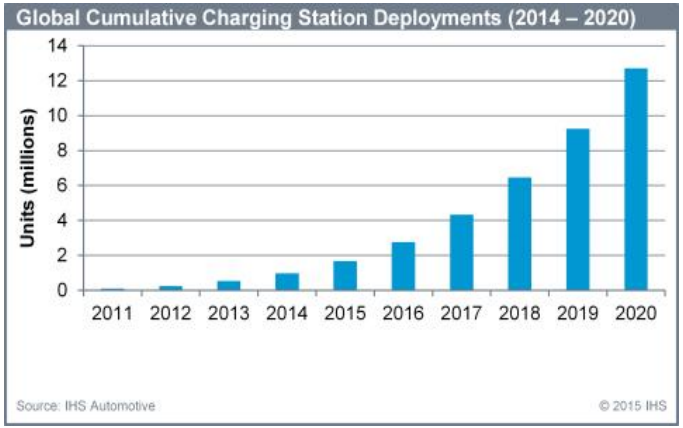
Why Electrical Vehicles

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.



When did it all start

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

Electric Vehicles

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)



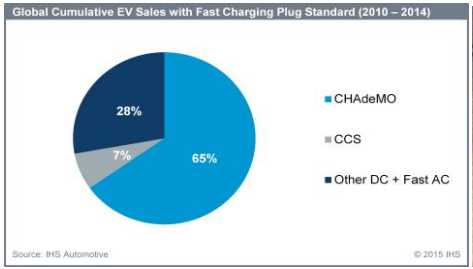


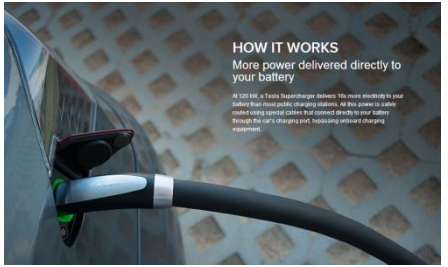

EV Charging

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





Delta Electrical Vehicle Charging Solutions

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 2Q/2016.
- Full charge in less than 30 minutes for passenger EV:s, IEC

Cordset

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

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.

AC Wall box & Mini

- Rating 200 – 240 VAC /16-32A
- 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

Service and Maintenance

- Regional spare part stock
- Regional L2 – service personel
- Local service and value add support based on Delta own locations
- Regional established and trained service partners

EVCS Installations

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

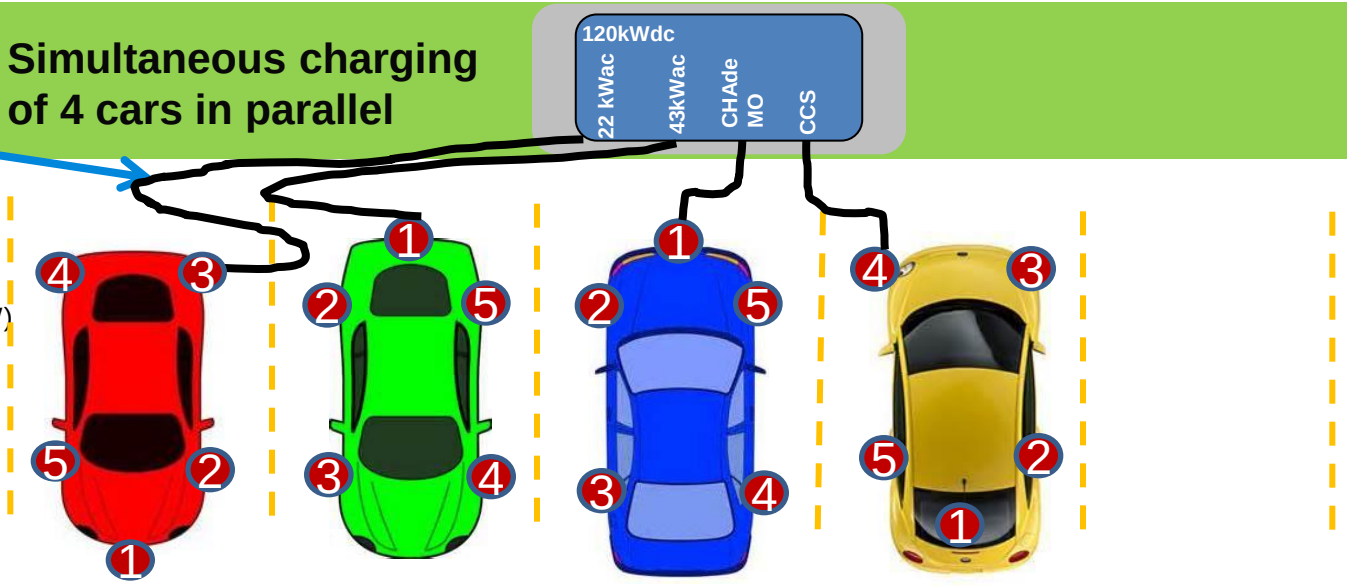
Uptime and quality

Total cost of ownership

Optimum Site Layout

Simultaneous charging of 4 cars in parallel

Connect with own AC cable



AC charging

1 - Audi: A3 & Q7 e-tron
1 - Renault: Zoe & Kangoo (43 kW)
1 - VW: GTE & Passat
2 - Opel: Ampera
2 - Volvo: V60 & XC90
2 - BMW: X5, i8
2 - Chevrolet: Volt
2 - Fisker: Karma
2 - Ford: Focus
3 - Smart
3 - Tesla: model S & X
3 - Porsche: Panamera Cayenne, 918 sypder
3 - Mercedes: B class
4 - Mercedes: S & C class
4 - Toyota: Prius

AC
all cars up to 22 kW

AC
all cars up to 43 kW

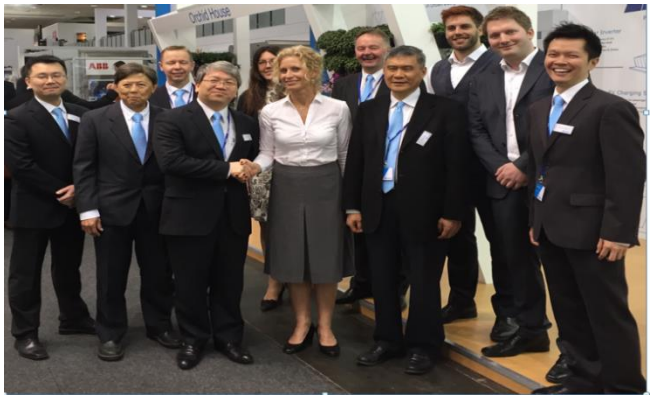
Chademo

1 - Kia: Soul EV
1 - Nissan: Leaf & e-NV200
3 - Mitsubishi i-Miev
3 - Citroen: C-Zero
3 - Peugeot: iOn
3 - Tesla model S & X (with adapter)
4 - Mitsubishi: Outlander

CCS:

4 - VW: e-Up & e-Golf
4 - BMW: i3

First installation in Vestby, Norway, Nov 10, 2015



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 kV

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

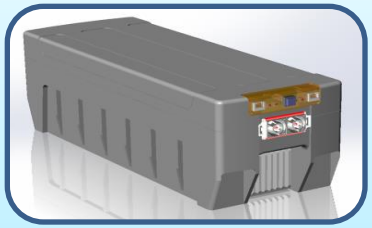
Applications for Battery Energy Storage Solution

Battery Energy Storage Solution

Solar PV Power

Wind Power

Grid

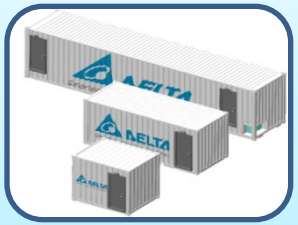


Battery Module

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

kWh scale Cabinet

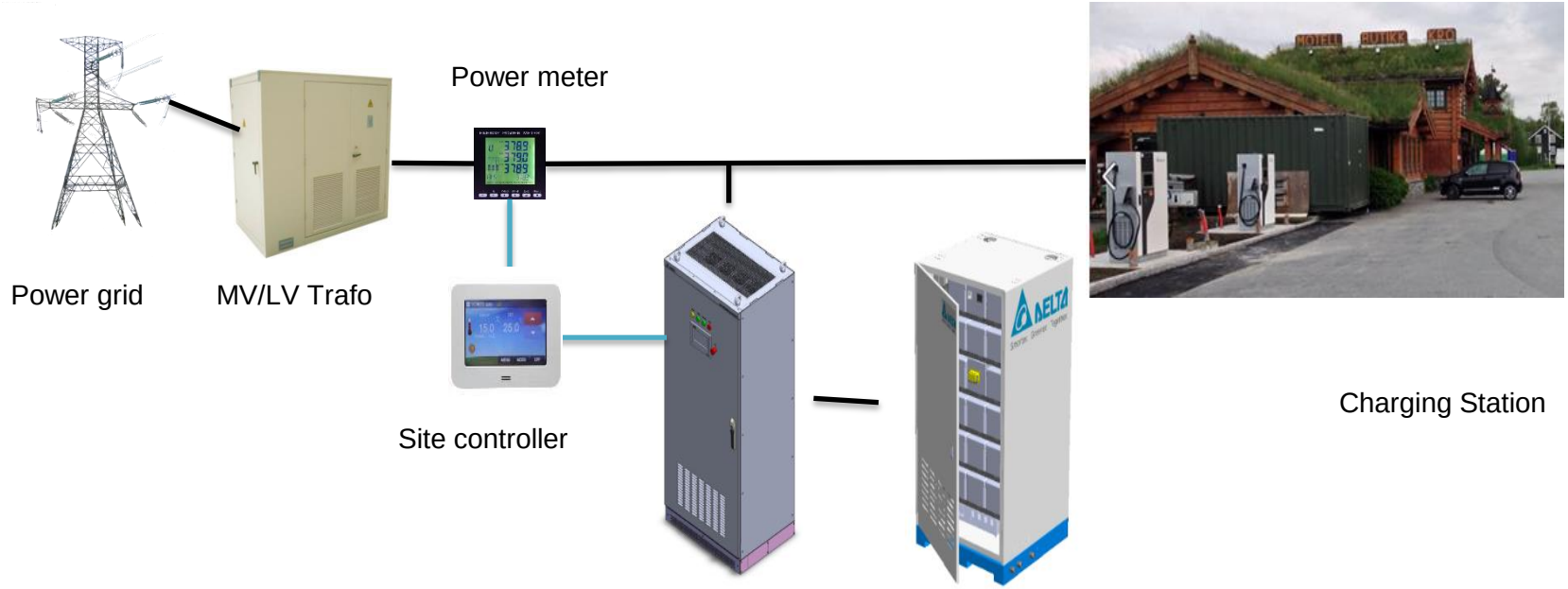
Power scale
- Micro Scale: < 10kW
- Middle Scale: 30-500kW
- Large Scale: 500kW-1MW+



Industrial/Utility scale up to MWh

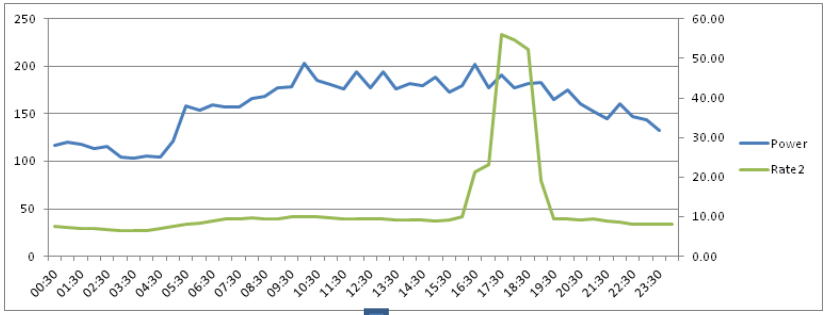
Features
- With EMS system
- High safety standards
- Long operating life

The solution with peak shaving and energy storage

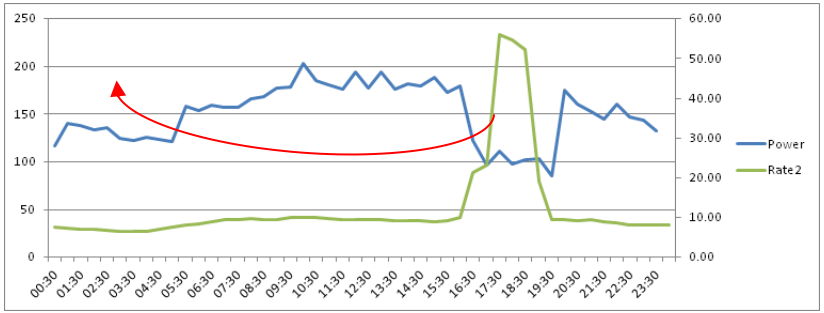


System operation

Without peak shaving



With peak shaving



- 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

Smarter. Greener. Together.

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.deltaww.com.