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WORLD OF ENERGY SOLUTIONS 01.10.2013, Fair Stuttgart

Introduction and first demonstration of CCS Combined Charging System as the new Standard for Electric Vehicle Fast Charging

Agenda

- Introduction
- EV charging: User point of view
- Technology& Standardization
- Demonstrations projects CCS - example „Schaufensterprojekte“
- Multistandard Solution
- Summary

A global leader in power and automation technologies
Leading market positions in main businesses

- ABB Global
  - 145,000 employees in about 100 countries
  - $40.2 billion in revenue (2012)
- ABB in Germany
  - > 10.000 Employees
  - Eduction rate 6 %
  - €3.7.2 million in revenue (2012)

How ABB is organized
Five global divisions

Power Products

$10.7 billion
36,000 employees

Power Systems

$7.9 billion
20,000 employees

Discrete Automation and Motion

$9.4 billion
29,000 employees

Low Voltage Products

$6.6 billion
31,000 employees

Process Automation

$8.2 billion
28,000 employees

(2012 revenues)

- ABB's portfolio covers:
  - Electricals, automation, controls and instrumentation for power generation and industrial processes
  - Power transmission
  - Distribution solutions
  - Low-voltage products
  - Motors and drives
  - Intelligent building systems
  - Robots and robot systems
  - Services to improve customers productivity and reliability
  - EV Charging Infrastructure

ABB DC fast charge installations
Proven technology in the field since May 2010








Installations in over 30 countries:
Germany, Norway, The Netherlands, UK, Ireland, Finland, Denmark, Sweden, Switzerland, Austria, France, Czech, Estonia, Turkey, Hungary, Italy, Hong Kong, China, USA, Taiwan, Slovenia, South Africa, Belgium, Slovakia, Bulgaria, Poland, China, Canada, Chile, Singapore, Northern Ireland

800 DC fast chargers installed / over 1.000 sold

Reference projects
DC fast charging infrastructure in Europe

Belgiun: VitaeMobility:

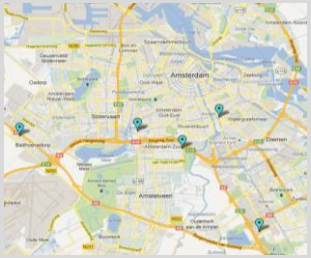
Irland: ESB eCars

ESB ecars
Leading the charge

Northern Ireland Electricity

Dänmark: CLEVER

Amsterdam: Taxiflotte:



TAXIE
taxi electric

Project Estonia: Country wide network “Elmo”
Europe’s largest EV infrastructure project

- Country wide network für EV´s
- 200 DC- Fast Chargers
- On DC fast charger along the main traffice routes (every 50 km
- 507 AC charge points
- Payment solution
- Service contracts

- In operation since Q1/2013

Fastned: Nationwide fast charging network
More than 200 fast charging stations in the Netherlands

- Always a charger within 50km.
- Each station equipped with several multi-standard fast chargers and solar canopies.
- Serving EVs from all major car brands, including CCS, CHAdeMO and Type-2 standards.
- ABB's open standard cloud connectivity platform enables user-friendly payment and access for all drivers.

ABB is active in many other projects world wide
Reference projects

Car OEMs

- Every Nissan Euro Leaf tested on an ABB Terra 52
- Both AC and DC charging tested using a Terra 52 dual charger

Petrol companies

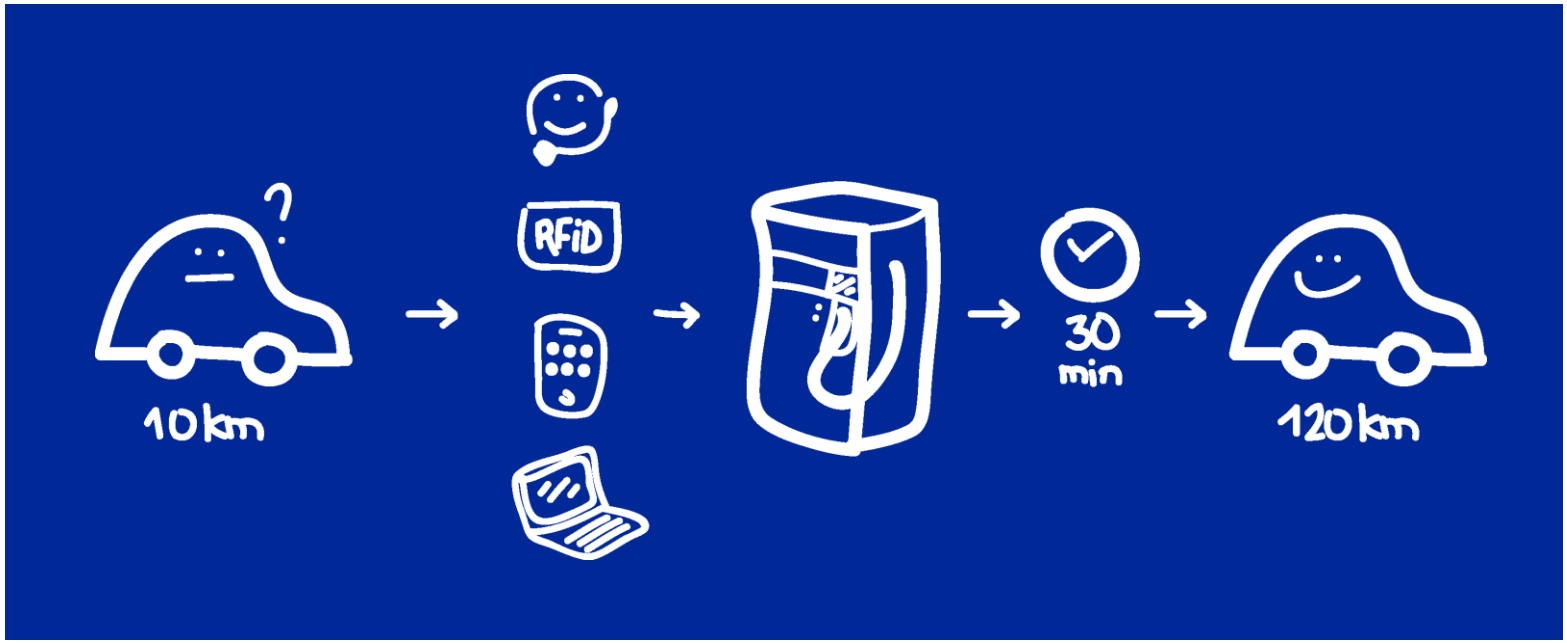
- ABB equipment installed in many fuel stations
- ABB personnel is trained to work in petrol station areas

Energy storage

- Collaboration projects with e.g. General Motors
- Implement storage integrated with chargers to save on TCO

Status nationwide charging network
In public an semipublic area in Germany?

User point of view
Full flexible mobility



Use cases in electric vehicle charging
Different solutions for each specific use case


Highway

- DC charging
- 15 - 30 minutes

Commercial

- AC & DC charging
- 30 - 120 minutes


Office

- AC & DC charging
- 30 - 120 minutes (fast)
  8 hours (“work day”)


Home

- AC & DC charging
- 120 minutes (“top-off”)
  8 hours (“overnight”)

The use case and habitat of various chargers
Each infrastructure solution has it's own parameters

AC Wall box

- **Charge time :4-8 h.**
- **Realistic service capability: 1 vehicle/day**

Fast Charger 50kW

- **Charge time: 15-30 min.**
- **Realistic service capability: 12 -20 vehicles/day**

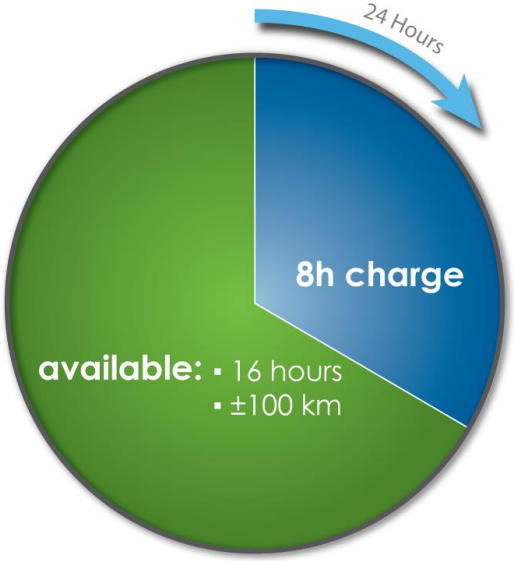
AC Charge pole

- **Charge time :4-8 h.**
- **Realistic service capability: 2 vehicles/day**

Fast Charger 20 kW / 22 kW

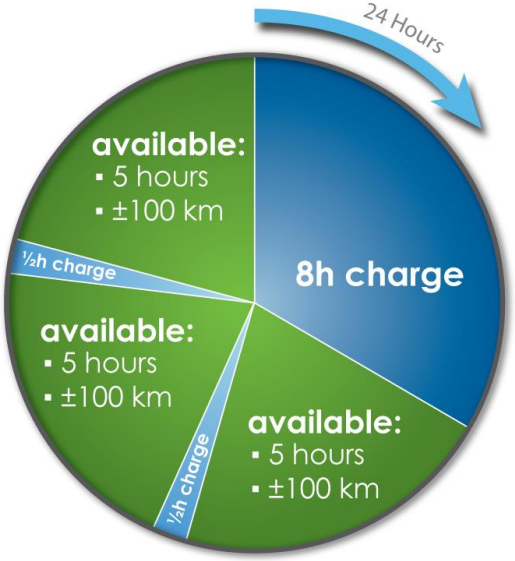
- **Charge time: 30-120 min.**
- **Realistic service capability: 5 -12 vehicles/day**

Consumers like to have these fast charge options available to extend the EVs' range



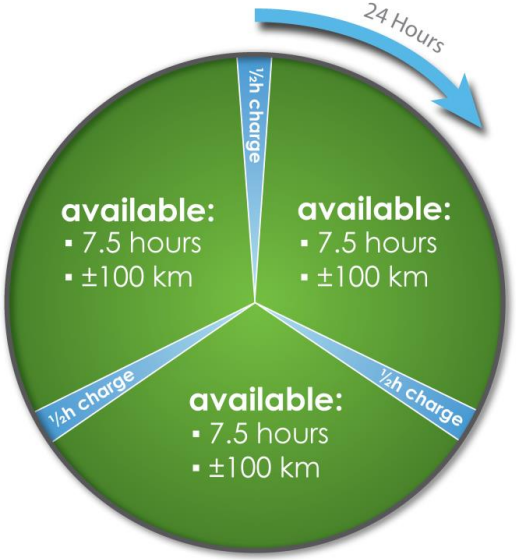
EV Slow Charging

- 16 hours
- 100 km



Slow Charging and Ultra Fast Charging

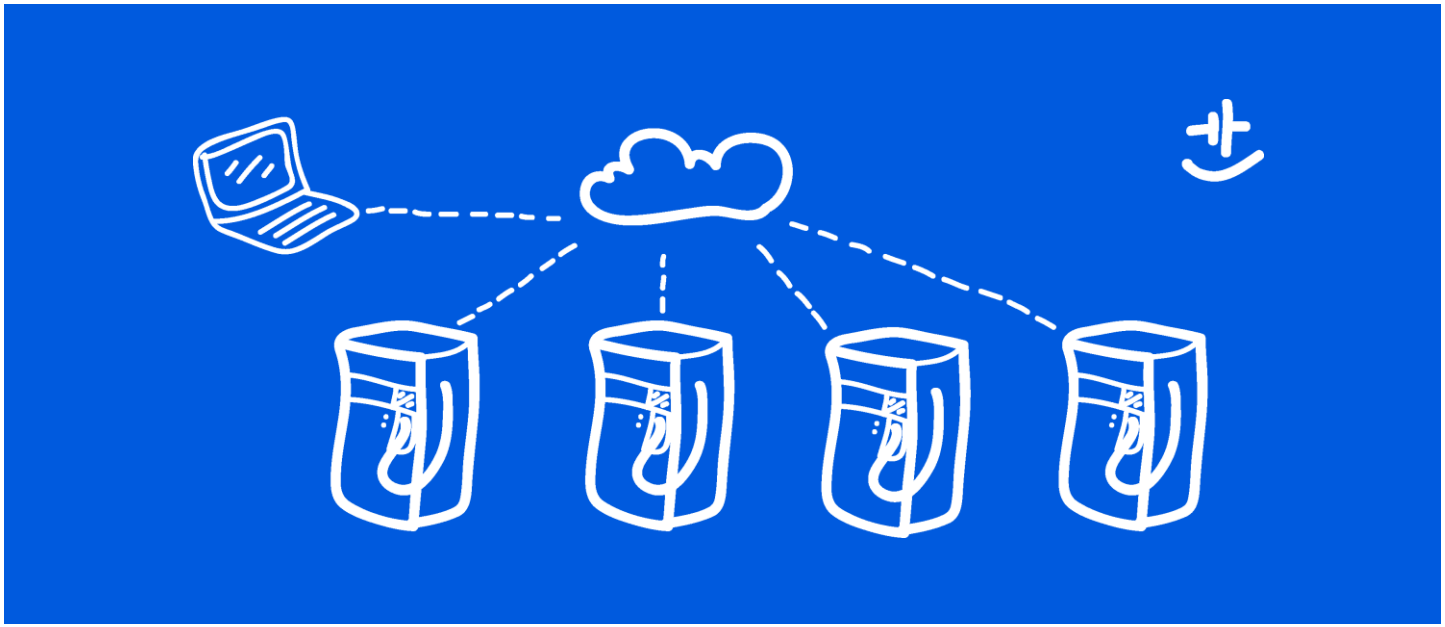
- 15 hours
- 300 km



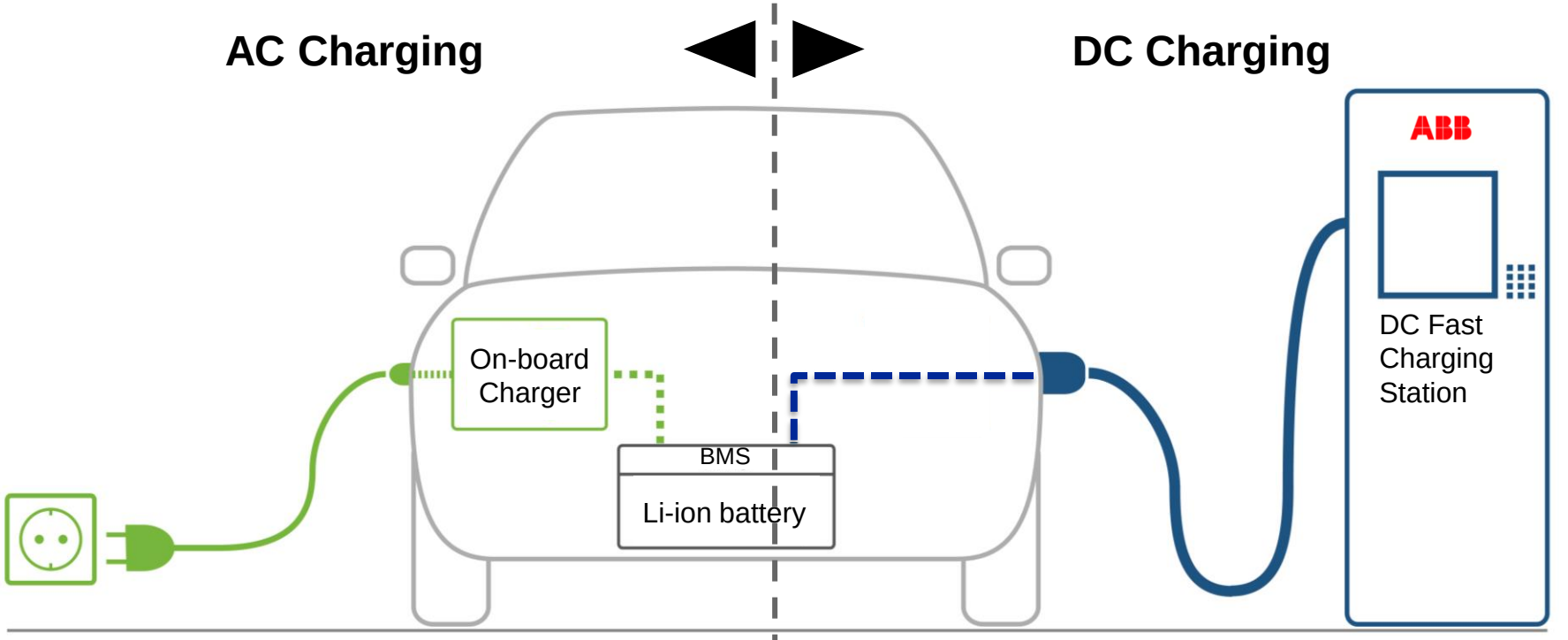
EV Ultra Fast Charging

- 22,5 hours
- 300 km

Charging Infrastructure for Electrical Vehicles
Technology & Standardization



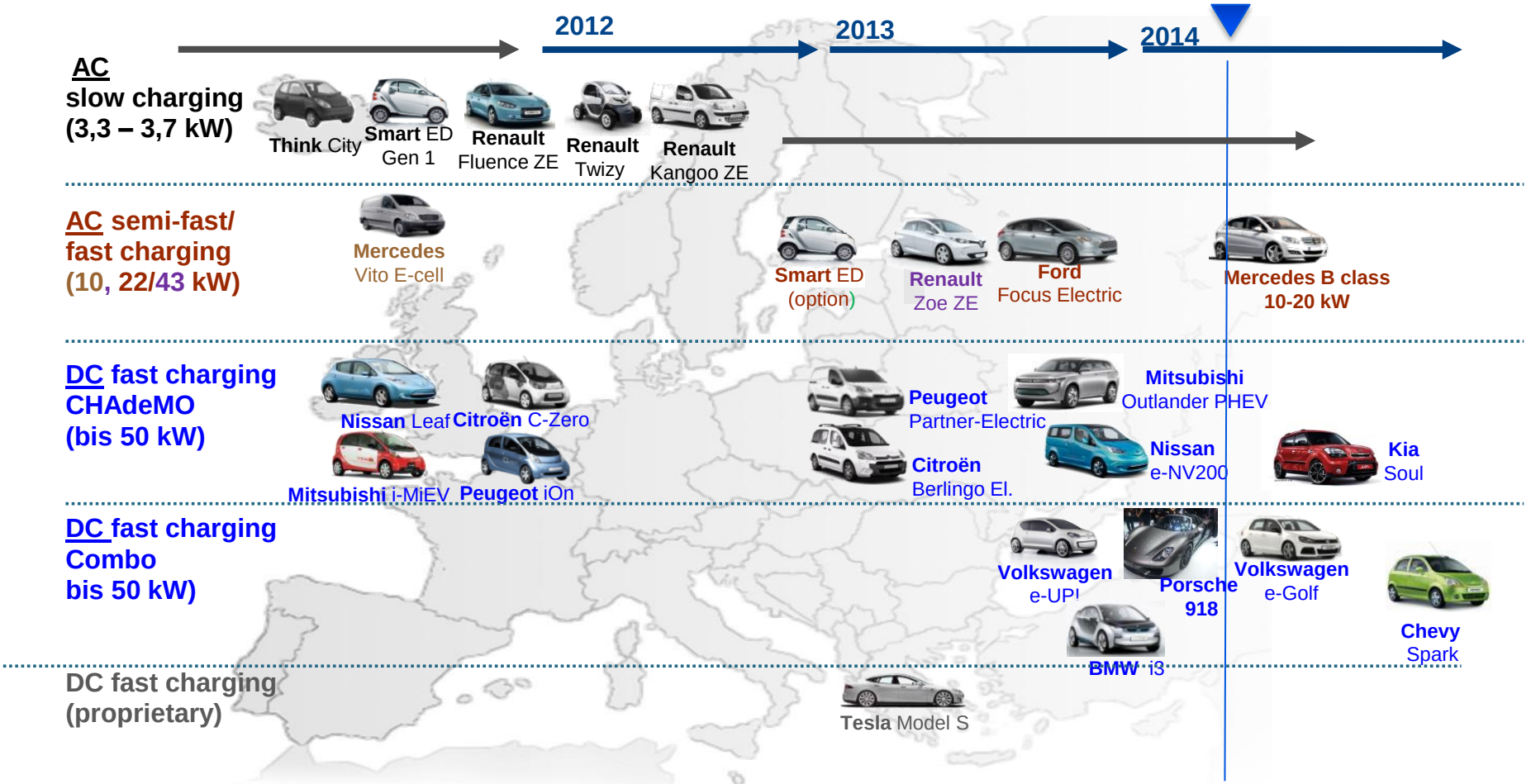
DC charging versus AC charging
On-board versus Off-board equipment



Every vehicle needs to have it's own onboard equipment

Infrastructure investment is shared with hundreds of users

Follow the car through Europe: Which car, when?
Which infrastructure is required



Carmaker support for various fast refill options

Majority of OEMs supporting DC fast charging

Supporting AC fast charge	Supporting DC fast charge & AC slow (3,3kW)
RENAULT, Ford, DAIMLER, smart open your mind.	NISSAN, MITSUBISHI, GM, VW, DAIMLER, Audi, BMW, PORSCHE, Ford, CITROËN, PEUGEOT, TOYOTA, CHRYSLER

The 22kW AC charge pole concept is a strange animal

Offering different charge speed depending on car type

22 kW AC public charge pole

Smart ED (option)
Renault Zoe

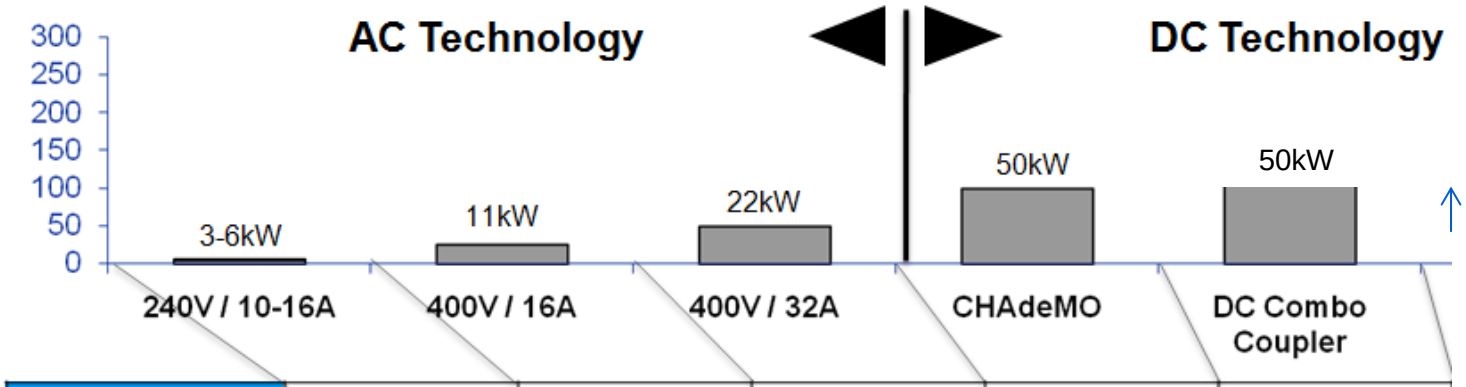
All other EV cars

The cost of the charge pole and especially the required grid connection is determined to a very large extent by the 22 kW specification

This additional cost seems only to the benefit of 2 cars

AC / DC Charging Standards

Reichweitengewinn in km
bei 30min Laden

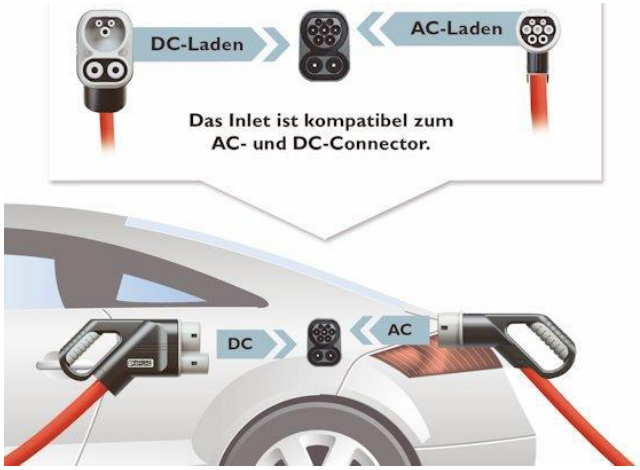


Stecker					
Kommunikation		ISO 15118	ISO 15118	CHAdeMO V0.9 CAN	ISO 15118 / J1772
Elektroautos	Praktisch alle				

Combined Charging System CCS – COMBO 2 connector

Source: Phoenix

Source: VDI



- Preferred Standard for Europe and North America
- Pushed by Audi, BMW, Daimler, Porsche, and Volkswagen, in close cooperation with American vehicle manufacturers (GM and Ford).

This universal charging system needs one single charging interface at the vehicle allowing the customer to charge with:

- One phase AC-charging
- Fast three-phase AC-charging
- Ultra-fast DC-charging at public charging stations.

International Conference Elektromobilität in Berlin
May 27th 2013

http://www.clipfish.de/video/3961627/aufladung-des-vw-e-up-ist-auch-fuer-bundeskanzlerin-angela-merkel-kein-problem/

“Schaufensterprojekte Elektromobilität” Program of the German Federal Government

- On the proposal of the National Platform for Electric Mobility (NPE), the Federal Government in 2012
- Showcase four regions selected. The German technological expertise should be made visible and tangible Technologies are developed practical and broad market introduction of electric vehicles to be prepared.
- Goal: 1 million electric vehicles on German roads by 2020.
- The Federation represents 180 million Euro of funding available

schaufenster elektromobilität
Eine Initiative der Bundesregierung

BAYERN – SACHSEN ELEKTROMOBILITÄT VERBINDET

BMW GROUP · MINI · DB Mobility Networks Logistics · Universität der Bundeswehr München · Otto-Friedrich-Universität Bamberg · TECHNISCHE UNIVERSITÄT DRESDEN · ABB · VORRWEG GEHEN · eight

SCHAUFENSTERPROJEKT

CCS DC FAST CHARGING OLYMPIAPARK

CCS DC fast charging
Olympiapark / BMW Welt / Munich

- **Government funded project under the International showcase Bavaria-Saxony "Electric Mobility connects“**
- The general public can now at the BMW Welt:
  - diversity,
    potential,
  - Fascination
  - experience of electric mobility.
- The charging station is the junction between electric cars, public transport and electric bicycle traffic (pedelec rental system)
- Between local & long distance traffic.

Schaufensterprojekt Bayern-Sachsen
CCS DC fast charging Olympiapark/BMW-Welt

Project goals:

- DC fast charging of EV's with CCS standard
- First DC fast charger installed in public area, based on the new combo-2 standard CCS
- Investigation of user acceptance and user behavior
- Development of sustainable business models for the operation of fast-charging infrastructure ->business competition award
- Development of an range monitor as support for route planning
- Bicycle traffic model for Munich by a pedelec rental system "e-Call a Bike”

Schaufensterprojekt Bayern-Sachsen
CCS DC fast charging Olympiapark/BMW-Welt

ABB Terra 53 C

Main features

- 50 kW DC charging CCS
- 80% Battery capacity in 15 – 30 min
- Software controlled

Easy of use

- 8‘‘ daylight readable touch-screen display
- Real time authentication interface

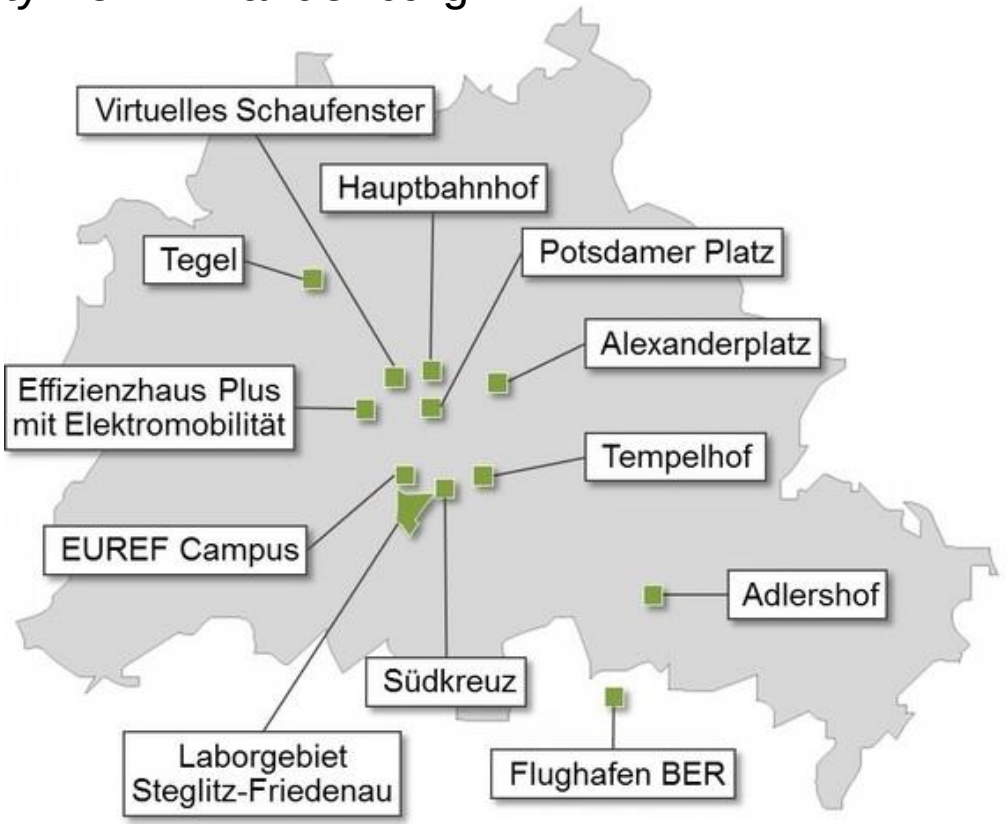
Future prove connection

- Remote monitoring and maintenance
- Flexible interfacing with added value systems
- Remote uptime monitoring and assistance
- Remote updates and upgrades

Schaufensterprojekt Bayern-Sachsen
CCS DC fast charging Olympiapark/BMW-Welt

Schaufensterprojekt Berlin-Brandenburg
DC- Combined Charging System CCS

Funded project under the International showcase electric mobility Berlin-Brandenburg



Schaufensterprojekt Berlin-Brandenburg
DC- Combined Charging System CCS

Project goals:

- Development and demonstration of combined DC-AC fast charging stations (CCS) at 8-10 central public locations in Berlin
- Validation and implementation of the developed hardware and software
- Interface definition and conceptualize electric vehicles and IT backend system and its demonstration in an urban environment
- Consideration of business models e.g. economy aspects
- Testing the appropriate application of different concepts (accounting, business and mobility models, etc.)

Fast charging standards

CHAdeMO / 22 kW AC / Combo

2010
CHAdeMO

Mid 2013
Combo 2

Q3 2012
22 kW AC

Use cases in electric vehicle charging
Different solutions for each specific use case

Highway
- DC fast charging
- 15-30 min

Commercial
- DC & AC charging
- 30-60 min.

Office
- AC & DC charging
- 30-60 min. (fast)
- 8 h (workday)

Home
- AC & DC charging
- 8 h (overnight)
- 2 h (top-off)

50 kW fast charging infrastructure
DC- fast charging in 15 – 30 minutes

Terra 53 C
DC
Highway
Charger

- 50kW DC CCS
- 15-30 min.

Terra 53 CT
DC + AC
Highway
Charger

- 50kW DC CCS
- 22kW AC
- 15-30 min.

Terra 53 CJ
DC
Highway
Charger

- 50kW DC CCS
- 50 kW DC CHAdeMO
- 15-30 min.

Terra 53 CJG
DC + AC
Highway
Charger

- 50kW DC CCS
- 50 kW DC CHAdeMO
- 43W AC
- 15-30 min.

Use cases in electric vehicle charging
Different solutions for each specific use case

Highway

- DC fast charging
- 15-30 min

Commercial

- DC & AC charging
- 30-60 min.

Office

- AC & DC charging
- 30-60 min. (fast)
- 8 h (workday)

Home

- AC & DC charging
- 8 h (overnight)
- 2 h (top-off)

20 kW / 22 kW fast charging infrastructure
Fast charging in 15 – 30 minutes

Terra 23 C
DC
Commercial Charger

- 20kW DC CCS
- 30-120 min.

Terra 23 CT
DC + AC
Commercial Charger

- 20kW DC CCS
- 22kW AC
- 30-120 min

Terra 23 CJ
DC
Commercial Charger

- 20kW DC CCS
- 20 kW DC CHAdeMO
- 30-120 min.

Terra 23 CJG
DC + AC
Commercial Charger

- 20kW DC CCS
- 20 kW DC CHAdeMO
- 22kW AC
- 30-120 min.

Terra multi-standard DC charging station

All- purpose EV fast charger

- The Terra multi standard
- Compatible with ALL CCS, CHAdeMO (0.9 & 1.0) and AC 43 kW compliant EV's from 2013 onwards
  - DC CCS 50kW/20kW
  - DC CHAdeMO 50 kW /20kW
  - AC 43kW/22 kW
- Terra 23 using widely available 3 x 32 A input (or 3 x 63 A)
- Simultaneous fast charging of DC and AC EV's
- Ultimate fast charging experience in 15/30 min
- Designed for Highway & City urban ring petrol/service locations, company fleets

Connectivity is key in this market

Back-office / Payment systems / Customer Services / …

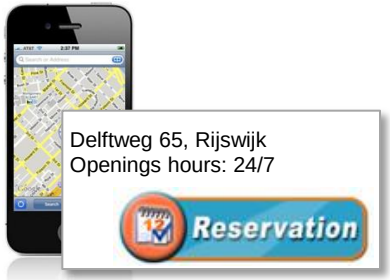
Authorization/billing

RFID

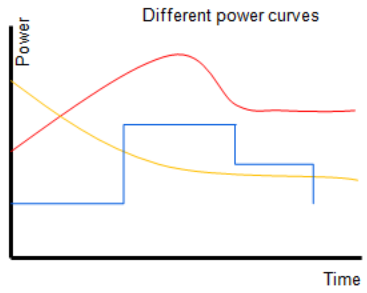
E-invoice

MasterCard VISA

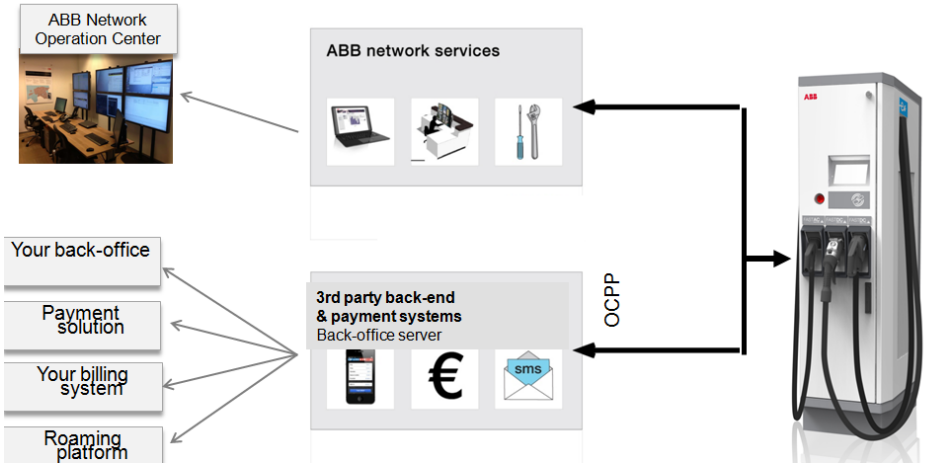
Reservation



Dynamic power



Availability



EV Charging Infrastructure
Summary

- Fast-charging infrastructure as essential part of efficient infrastructure in public/semi public area
- Maximum availability and use of electric vehicles through smart, networked charging solutions
- Scaled charging technology for various user groups and operator models
- Overwhelming number of electric vehicles are DC , fast chargable
- Software and system integration as building blocks of an efficient charging infrastructure
- Efficient remote support for high system availability
- “Schaufensterprojekte” are important showcases to promote/bring forward e-Mobility in Germany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