Fast Charging Gets Faster

EV Roadmap Conference - Portland
ABB EV Charging

Mission Statement – EV Charging Team

We offer DC Charging solutions for Electric Vehicles...

...from 10-600KW...

...based on standards...

...in all countries...

..with cloud connectivity..

...using ABB technology...

and ABB manufacturing.
EV DC fast charging and global standardization

ABB leading in major developments this decade

2010
- Founding of CHAdeMO
  - ABB was involved from the start

2010
- Launch ABB Terra 51
  - 50 kW CHAdeMO charger

2010
- First 50 kW charger in EU
  - Based on proprietary standard, no consumer EV’s available

2010
- First EV’s with DC charging
  - Nissan Leaf & Mitsubishi iMieV

2012
- Founding of CCS alliance
  - ABB was involved from the start, basis for IEC standard

2012
- Launch CCS & multi-standard Terra 53
  - CCS + CHAdeMO + AC

2012 - 2013
- First nationwide DC networks
  - ABB in Estonia, Denmark, Netherlands

2013
- Launch CCS & multi-standard Terra 53
  - China, USA, APAC

2013-2015
- First nationwide DC networks
  - ABB in Estonia, Denmark, Netherlands

2014, >
- Leading Connectivity & uptime
  - ABB has industry leading uptime by remote management and supports global payment solutions

2016
- First eBus chargers in EU
  - Global partnerships with bus OEMs

DC home

OppCharge

Higher power

Near Future

IEC 61851-23

Multi-standard

Global EV spread

OppCharge

E-bus

Multi-standard

Global EV spread

OppCharge

E-bus

Multi-standard

Global EV spread

OppCharge

E-bus

Multi-standard

Global EV spread

OppCharge

E-bus

Multi-standard

Global EV spread

OppCharge

E-bus

Multi-standard

Global EV spread

OppCharge

E-bus
**Driver: The EV range roadmap for EU, USA, APAC**

Batteries get bigger, range gets longer

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mass market EVs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80 miles</td>
<td>&gt;120 miles</td>
<td>&gt;200 miles</td>
<td>&gt;300 miles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 kWh</td>
<td>&gt;30 kWh</td>
<td>40-60 kWh</td>
<td>&gt;80 kWh</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Premium EVs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;300 miles</td>
<td>&gt;80 kWh</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Charging on the road**
- 50 kW
- 3-6 kW AC

**Charging at commercial locations**
- 3-20 kW
- 3-6 kW AC

**Charging at home / office**
- 150-350 kW
- 20-50 kW
- 10-20 kW

**Small cars:**
- 50 - <150 kW

**Mid/ high segment:**
- 120 - 150 kW

**Top segment:**
- ~300 kW

©ABB

Month DD, Year
ABB in the lead for new high power standard (2018)

CCS standard changes required for power >150 kW

<table>
<thead>
<tr>
<th>Standard</th>
<th>Specification (today)</th>
<th>Max charging power for EV car</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHAdeMO</td>
<td>50-500V, 125A</td>
<td>~50 kW</td>
</tr>
<tr>
<td>CCS</td>
<td>200-500V, 200A</td>
<td>~95 kW</td>
</tr>
</tbody>
</table>

### CCS today

- CCS connector
- 200 – 500 V<sub>DC</sub>
- 200 A<sub>DC</sub>
- Up to ~95kW charging power

### New high power CCS

- Special CCS connector, backward compatible with today’s cars
- Up to 920 V<sub>DC</sub>
- 350/500A<sub>DC</sub>
- 150kW – 350 kW/460kW charging power
- Power electronics cabinet parameters changed
  - Current
  - Voltage
  - Safety concept
  - Isolation concept
  - Electro Magnetic Compatibility (EMC)
  - Power quality
  - Accuracy

CE / UL charger certification based on today’s standard
Network roll-out of high power DC charging

Networks to serve short range EVs will expand fast

Today
- Short distance small EVs
- 120 miles range
- 50 kW charging networks are growing

>2017
- Fast growth of short/medium distance small EVs (200 miles)
- Higher density 50 kW networks
Network roll-out of high power DC charging

Networks to serve short range EVs will expand fast

Today
- Short distance small EVs
- 120 miles range
- 50 kW charging networks are growing

>2017
- Fast growth of short/medium distance small EVs (200 miles)
- Higher density 50 kW networks
- Introduction long distance premium EVs (>300 miles range)
- High power corridors between cities
Cumulative EV population estimate

In 2020 most EVs on the road still have < 50 kW capability
In 2020 most EVs on the road have < 50 kW capability.
ABB modular upgradable high power charging solution

User friendly system up to 460kW 920V 500A per output

NOTE: design subject to change
ABB modular upgradable high power charging solution
Managing the load on the grid and optimizing charging assets

10 kV, 20 kV

1 x 1.2 MVA substation

480VAC

6 x 350/460kW 500A per outlet
Roll-out of first high power charge park with EVgo
E-bus product: 150kW to 600kW charging via automatic connection
Contact information

Johan Peeters
VP Marketing and Sales
ABB B.V.
EV Infrastructure
High Tech Campus 5, Room p-093
5656 AE Eindhoven
The Netherlands
M: +31 6 51211018
E: johan.peeters@nl.abb.com
I: http://www.abb.com/evcharging

Randal Kaufman
Regional Sales Manager
ABB Inc.
EV Infrastructure
4050 E. Cotton Center Blvd.
Phoenix, AZ 85040
USA
M: +1 760 576 9076
E: randal.kaufman@us.abb.com
I: http://www.abb.com/evcharging