ABB ELECTRIC VEHICLE CHARGING INFRASTRUCTURE FORUM 2018

Driving the future of e-mobility with ABB

Sami Raitakoski, Executive Vice President, APAC, Electrification Products Division

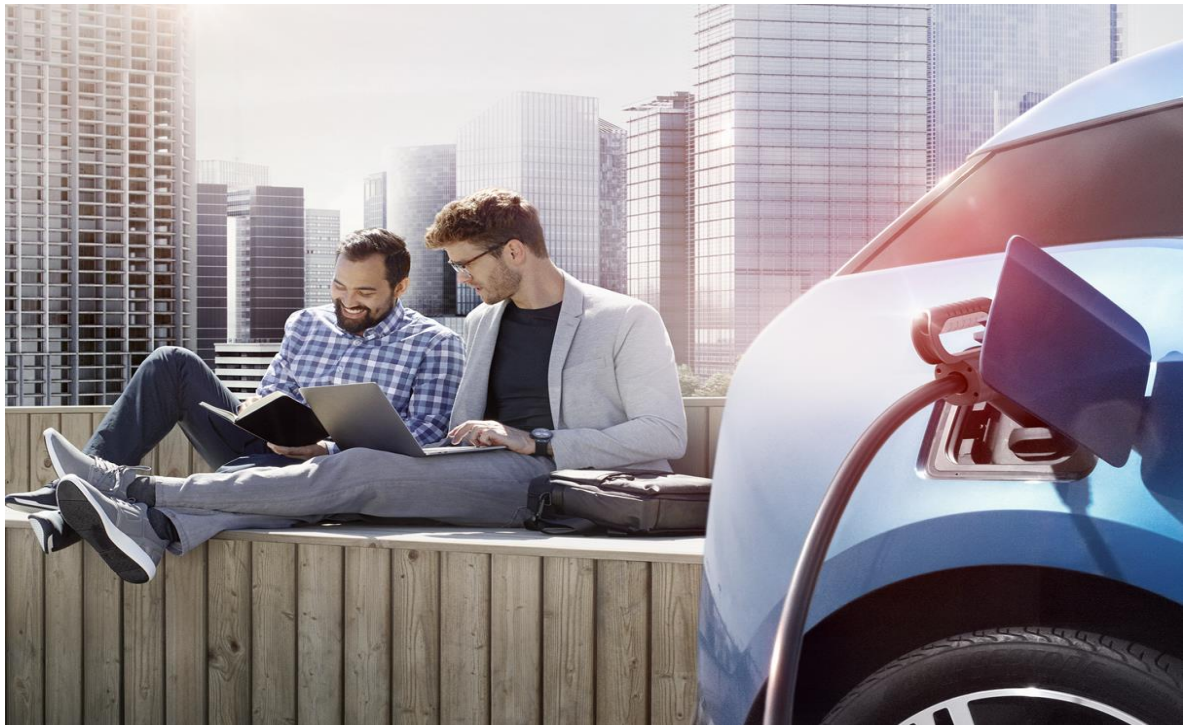
Welcome

Programme

Driving the future of e-mobility

08:30 AM	Registration
09:00 AM	Welcome address
09:15 AM	Global Industry Trends for Electric Vehicles
09:45 AM	Car charging overview - AC infrastructure
10:15 AM	*Tea-break* at “The Byte”
10:45 AM	Car charging overview - DC and High Power infrastructure
11:30 AM	Bus and truck charging infrastructure
12:00 PM	ABB Ability™ and Connected Services for EV Charging Infrastructure
12:30 PM	Q&A
12:50 PM	Conclusion, followed by Lunch at “The Byte”

Driving the future of e-mobility



Driving towards a cleaner, sustainable environment for future generations to live, work and play.


ABB

SMARTER MOBILITY

Global Electric Vehicle Industry Trends

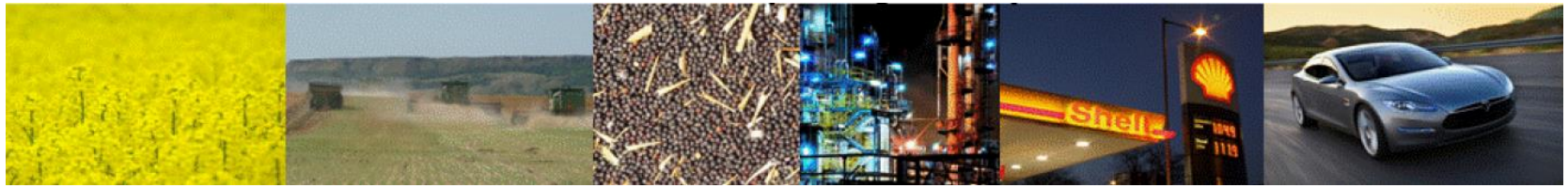
ABB Electric Vehicle Infrastructure Forum 2018

Johan Peeters, Global Sales Manager, EVCI, ABB

Well-to-wheel efficiency of alternative fuels

Range per year per m² of land

Biofuel: 7km



Most efficient energy crops (palm oil, sugar cane) deliver **0.5L/m²** including sowing, fertilizing, harvesting, refinement and distribution.

A vehicle drives **15km/L,** so 0.5L gives **7km** range.

Hydrogen: 160km

A solar panel delivers **105 kWh/m²**

After electrolysis, compression and distribution **63kWh** goes into the tank.

The fuel cell generates **31.5kWh** of electricity.

The vehicle drives **5km/kWh,** so 31.5kWh gives **160km** range.

Electric: 380km

A solar panel delivers **105 kWh/m².**

After distribution, charging and storage in the battery, **77kWh** is available to the motor.

An EV drives **5km/kWh,** so 77kWh gives **380km** range.

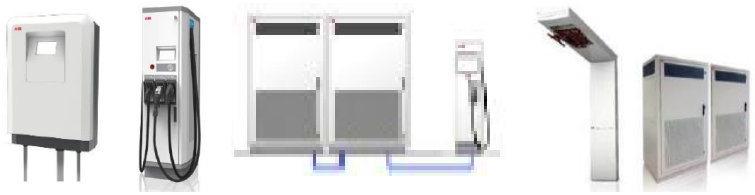
Original source: Auke Hoekstra, Eindhoven University of Technology. Data was modified due to improved performance of biofuel and hydrogen.

ABB EV charging

Mission statement – EV Infrastructure team

We offer AC and DC charging solutions for Electric Vehicles…

…from 3-600kW…



…based on standards…

…in all countries…

Present in
60+ countries

..with cloud connectivity..

…using ABB technology…

and ABB manufacturing.

EV 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

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

2013
Launch CCS & multi-standard Terra 53
CCS + CHAdeMO + AC

2013-2015
Launch global variants Terra 53
China, USA, APAC

2016
First eBus chargers in EU
Global partnerships with bus OEMs

2018
First eTruck chargers
Global partnerships with OEMs

CHAdeMO — **CCS alliance** — **Multi-standard** — **E-bus** — **Higher power** — **Near future**

Pilots — **First EV's** — **IEC 61851-23** — **Global EV spread** — **OppCharge** — **DC home**

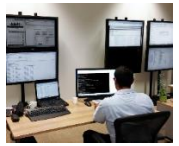
2010
First 50 kW charger in EU
Based on proprietary standard, no consumer EV's available

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

2012
First demo of CCS charging
ABB & CCS alliance at EVS26 Los Angeles, USA

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

2012, >
ABB leading Connectivity & uptime
ABB has industry leading uptime by remote mnmnt



2014 - >
DC networks spread globally
Europe, USA, Asia

2017
Launch of high power for cars
150-350kW fast charging for next generation EV's

2018
Gen2 charge post and Terra 54HV
Next steps in High Voltage charging

ABB DC fast charge installations

Proven technology in the field since May 2010, now in 68 countries

Actual

Argentina, Australia, Austria, Azerbaijan, Belgium, Brazil, Bulgaria, Canada, China, Chili, Colombia, Croatia, Czech, Denmark, Egypt, Estonia, Faroe Islands, Finland, France, Germany, Georgia, Greece, Greenland, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Italy, Japan, Jordan, Kazakhstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malaysia, Mexico, Monaco, The Netherlands, New Zealand, Norway, Peru, Philippines, Poland, Reunion Island, Romania, Russia, Saudi Arabia, Serbia, Singapore, Slovakia, Slovenia, South Africa, South Korea, Spain, Sri Lanka, Sweden, Switzerland, Taiwan, Thailand, Turkey, United Arab Emirates, Ukraine, United Kingdom, USA.

Total more than 8.000 DC fast charging units sold
of which more than 1.000
150 and 300kW High Power Charging systems (for car and bus)

ABB is global charging partner for Car, Bus and Truck OEMs

Strong presence in China, USA and Europe

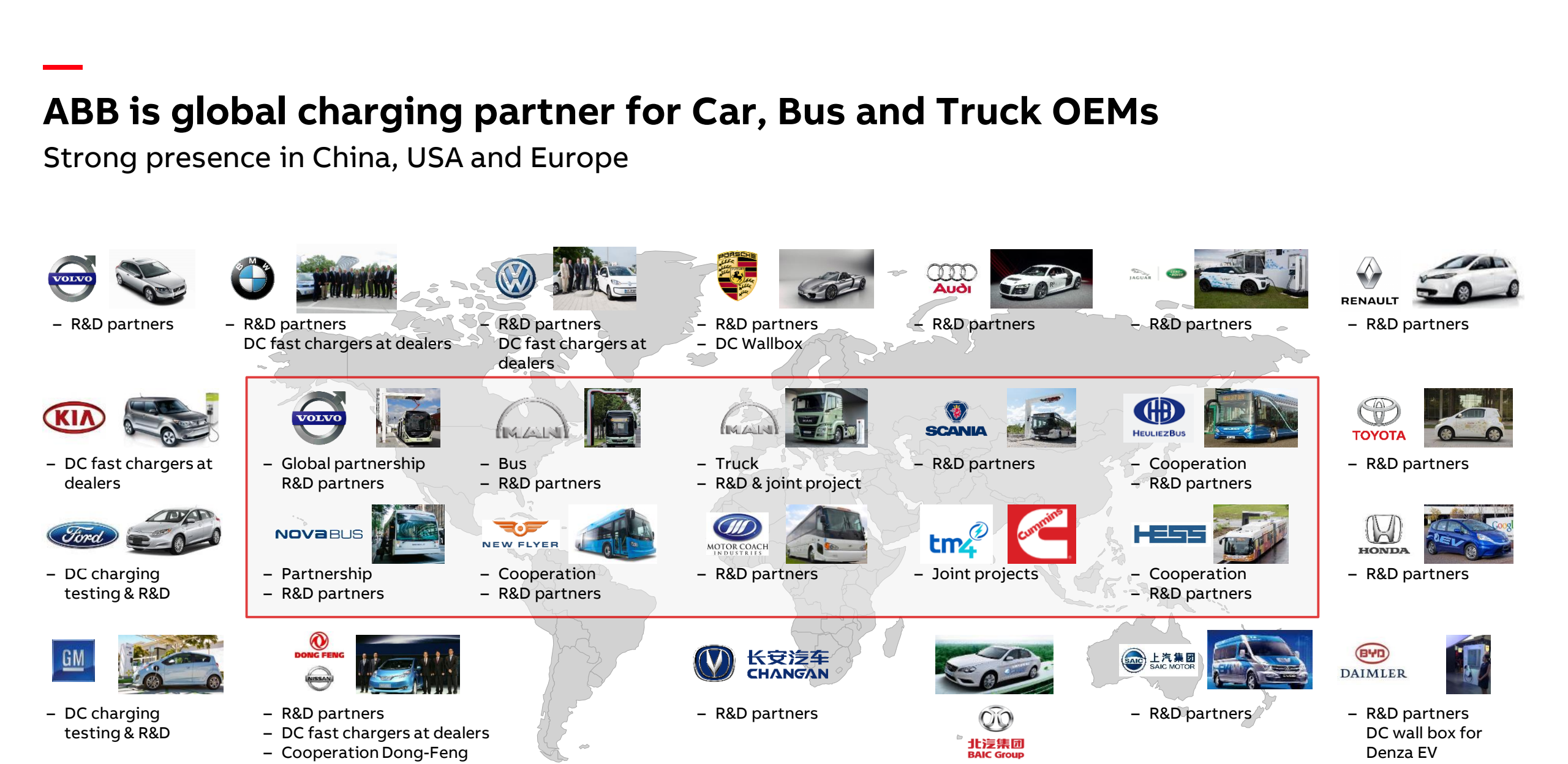


ABB and Formula E

Group press release Zurich, Switzerland, 09 January 2018

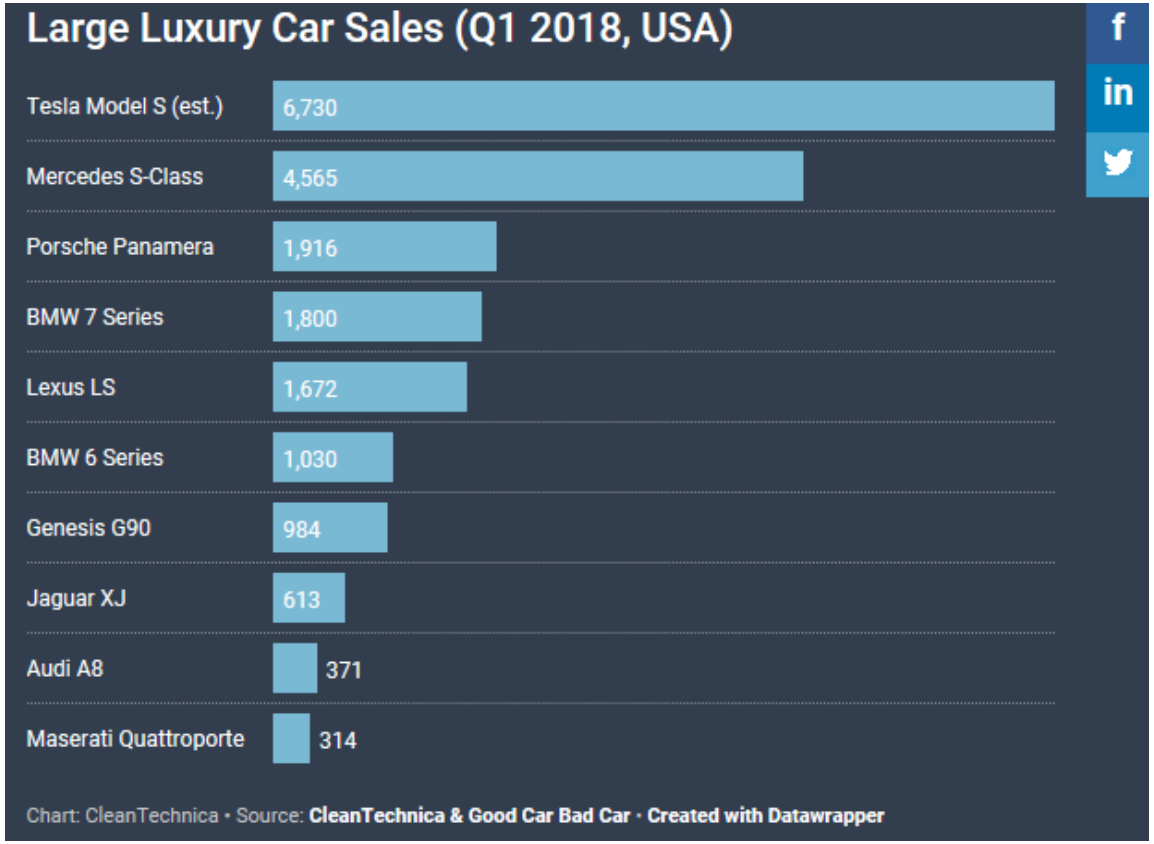
Together, Formula-E and ABB are defining the roadmap for electric mobility through motor sports.

Our partnership for the ABB FIA Formula E Championship is fostering high-performance racing around the world to pioneer the latest energy and digital technologies – one electrifying race at a time.

Let's write the future. Together.

Tesla Model S Sales

Large Luxury Car Sales (Q1 2018, USA) & Germany's premium brands under pressure in Europe



Clean technica article on April 22nd, 2018 by Zachary Shahan

- Out of 10 large luxury car models, the Tesla Model S takes a notable 34% of sales. The Mercedes S-Class follows it most closely with 23% of sales.

Automotive News Europe article on February 20th, 2018 by Nick Gibbs

- Germany's premium brands are under pressure to accelerate their plans for electric cars after Tesla's Model S outsold the luxury flagships of Mercedes-Benz, BMW and Audi in Europe for the first time.

- European sales of the Model S outstripped German premium brands' range-topping sedans including the Mercedes S class and BMW 7 series.

eMobility now also in premium middle-class segment on 1st position, in USA

Latest news on Tesla Model 3: now on 52% market share of premium middle class limousines in the USA

The Model 3 now holds a 52 percent market share of premium middle class limousines in the USA,

making it more popular than all other cars in the segment put together.

electrek.co, twitter.com, teslamotors.com

(Source: electrive.com of August 3rd , 2018)

AC charging versus DC charging

On-board versus Off-board equipment

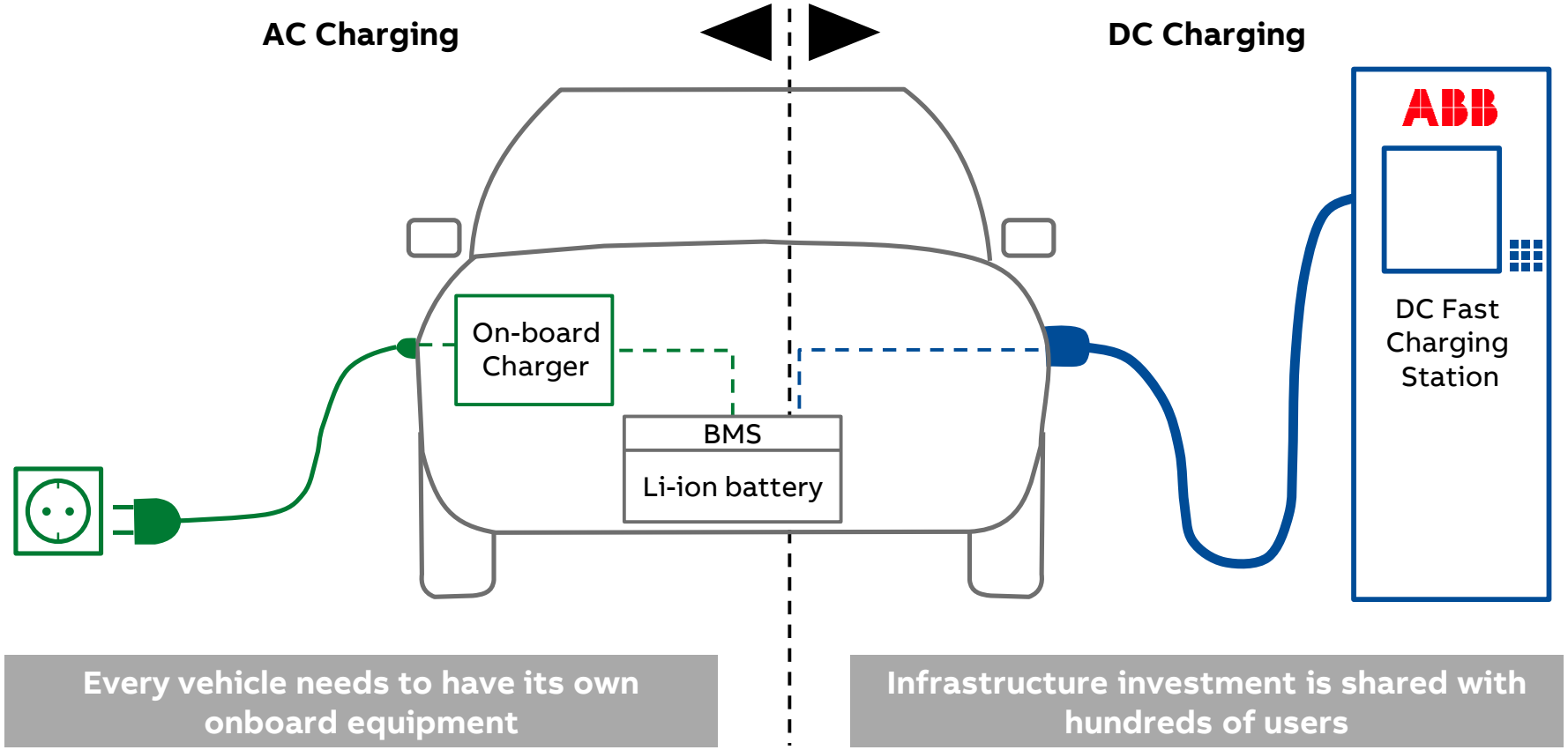


ABB is following the OEM Fast Charging standards

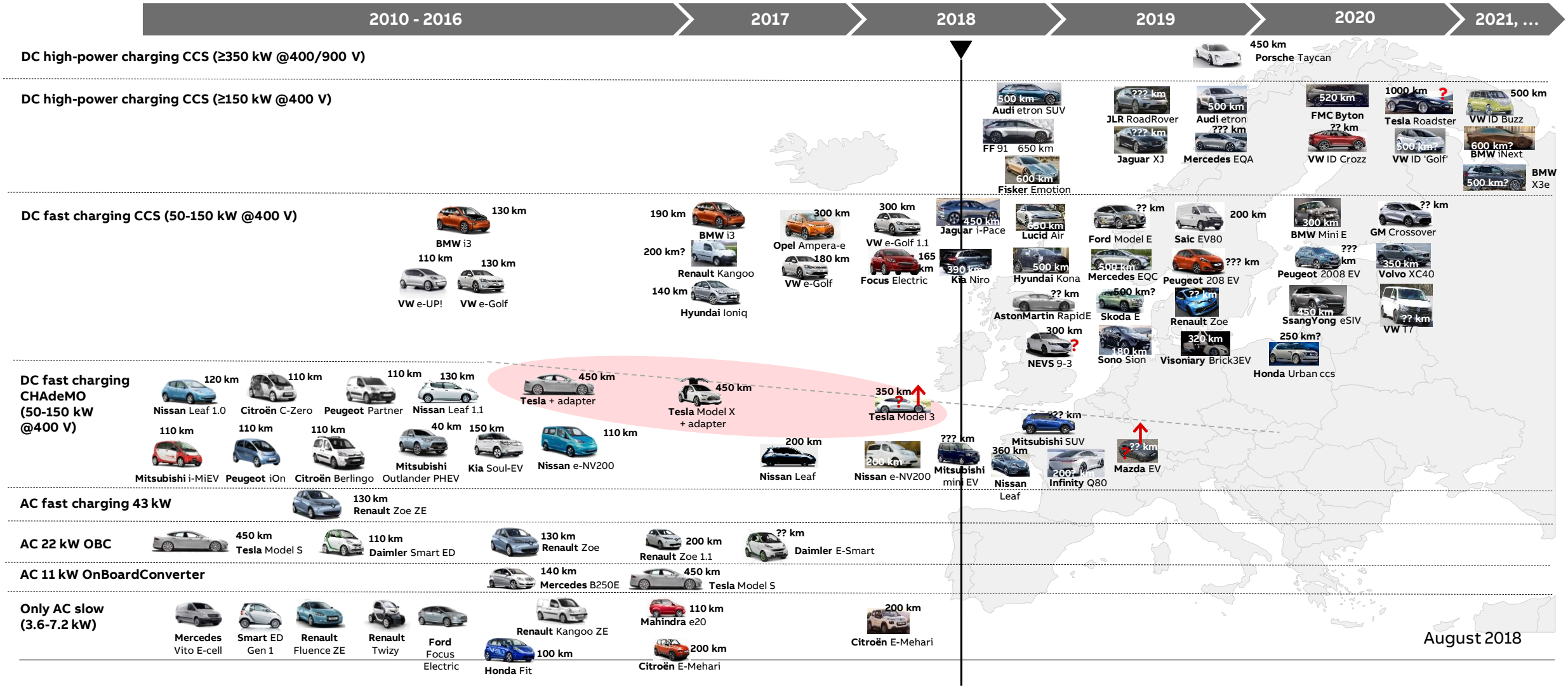
50kW CHAdeMO/ 22-43 kW AC/ 50kW - 350kW CCS 2

From Q4-2013
CCS 2

From Q4-2012
22-43 kW AC

From Q4-2010
CHAdeMO

Follow the car through Europe, and open standard protocols



Driver: The EV range roadmap for EU, USA, APAC

Batteries get bigger, range gets longer

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Mass market Evs	**~140km**				**>180km**		**>250km**			**>400km**	
	24 kWh				>30 kWh		40-60 kWh			>70 kWh	
Premium EVs							**>450km**				
							>80 kWh				
	50 kW				Charging on the road					150-350 kW	
	3-20 kW				Charging at commercial locations					20-50 kW	
	3-6 kW				Charging at home/ office					10-25 kW	

Small cars:
50 - <150 kW

Mid/ high segment:
120 - 150 kW

Top segment:
~300/350 kW

Public and commercial car charging – Use cases

Charging service should match charging application and demand

Public and commercial EV Charging

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SMARTER MOBILITY

EVLunic AC Wallbox

Unlimited AC Car charging possibilities

Kumail Rashid, Sales Manager, EVCI, ABB

EVLunic AC electric vehicle chargers with 4.6 kW – 22 kW

Applications

Public and commercial car charging – Use cases

Charging service should match charging application and demand

Public and commercial EV Charging

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	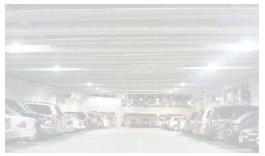		
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EVLunic AC Wallbox

Portfolio details

Models

EVLunic	**B**	– Entry level chargers with basic options
	B+	– Entry level chargers, with full power range available and with authentication options
EVLunic	**Pro S**	– Smart chargers with energy meter, connectivity, OCPP and load balancing through a smart master
	Pro M	– Smart chargers with energy meter, connectivity, OCPP and load balancing. Can serve as the central device for OCPP and load balancing for up to 15 Pro S devices

EVLunic AC Wallbox

Charging Infrastructure for many places

Relevant places for AC charging solutions depending on the time you park your car, normally 2-8 hours.

Home

Car is parked on property of the owner

Multi family building

Car is parked in shared space

Work places like office

Charger is there for own employees or visitors

Street

Charger is in public space

Commercial

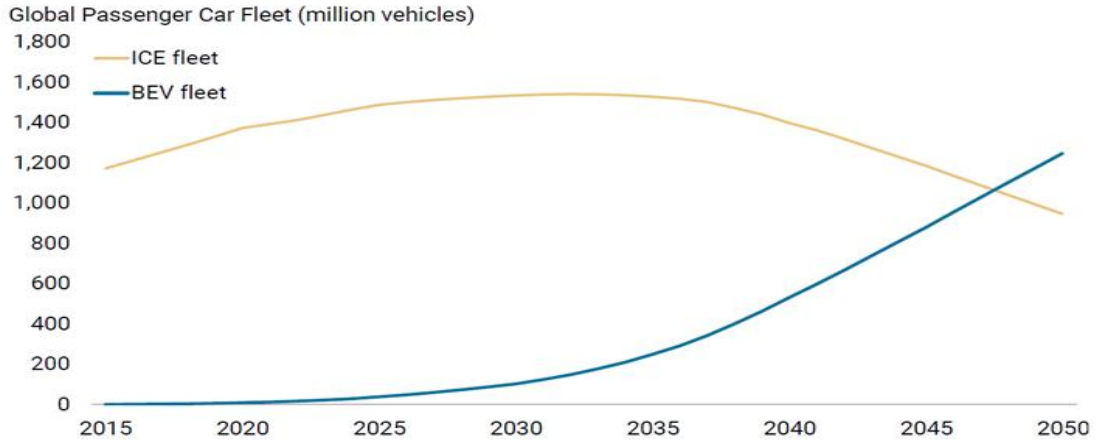
Charger is used to attract customers or is commercially operated

GPG EVI – AC Charging

Global Outlook

BEV and numbers of AC level 2 chargers

- Morgan Stanley and Goldman Sachs expect 1 Bn BEV by 2050
- Estimated number of BEV by 2030 of approx. 100 - 150 Million
- Expected ratio: 1.6 level 2 AC Charger per car
- By 2030 the amount of installed AC Chargers will be between 160 Million and 280 Million



Source Morgan Stanley Research estimates

Estimated capex required for the necessary charging infrastructure by charger type

	Number of chargers (mn)	Weighted avg. cost per charging point ($)	Deflation	Total cost ($bn) (post-deflation)	Of which	
					Equipment	Installation
Level 1	600	$1,250	25%	$563 bn	$270 bn	$293 bn
Level 2	1,680	$1,600	25%	$2,016 bn	$1,124 bn	$893 bn
Fast charging	1.5	$32,500	25%	$37 bn	$23 bn	$14 bn
Total	**2,282**			**$2,615 bn**	**$1,416 bn**	**$1,199 bn**

Source: Goldman Sachs Global Investment Research.

EVLunic AC electric vehicle chargers

Majority of charge sessions will be AC

Facts and Trends

- Cars are parked for 97 % of the time
- Driving and parking habits suggest 80+ % of charging will be done overnight and at home
- < 6 % of charging is expected to happen in fast charging stations
- 70 % of total night chargers will be wall mounted on private property
- Day time charging units will be mounted in public areas

EVLunic AC electric vehicle chargers

Majority of charge sessions will be AC

Expectation 2050

- Total number of AC L2 chargerpoints worldwide expected by Morgan Stanley to be 1.7 bn by 2050

- 980 million AC level 2 wall mounted units

- 700 million AC level 2 pole units

- Number of AC L2 chargers is 1.6 times the number of EV's

- Nighttime charger unlikely to be shared

- Day charger used for 3 hours or less per charge session

- Day charger has an average not more than 3 charge sessions/day

EVLunic AC Wallbox

Portfolio details

Options

Outlet type	– Type 2 AC socket – Type 2 AC socket with shutters – Type 2 AC cable 4m – Type 2 AC cable 6m – Type 1 AC cable 4m
Maximum power	– 4.6 kW – 11 kW (type 2 cable models only) – 22 kW (type 2 models only)
Authentication	– None – Key (B+ models only, cylinder can be replaced) – RFID (MIFARE)
UMTS/3G	– No – Yes (Pro_M models only)
Pedestals (sold separately)	– None (wall mounted) – Pedestal for one wallbox – Pedestal for two wallboxes back to back – Pedestal for two wallboxes at a 90 degrees angle

EVLunic AC Wallbox

Portfolio overview

Specials

- **Authentication**
  via key or RFID
- **OCPP1.5**
  supports direct connection to the customer cloud
- **Updates**
  can be installed via USB, via the web interface or via OCPP
- **Load management**
  for up to 15 Pro S devices which can be connected
  to one Pro M device to share the load
- **Cyber security**
  solid after test chaos computing hack with outdated software

Note: All options are to found in the selection sheet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Networking tea-break

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SMARTER MOBILITY

Car Charging Overview – DC and High Power Overview

ABB Electric Vehicle Infrastructure Forum 2018

Johan Peeters, Global Sales Manager, EVCI, ABB

Public and commercial car charging – Use cases

Charging service should match charging application and demand

Public and commercial EV Charging

AC destination	DC destination	DC Fast	DC High Power
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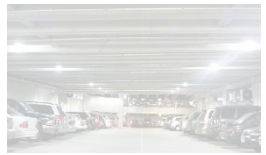			
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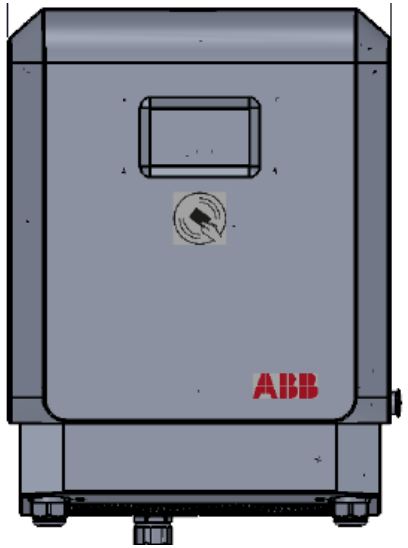
DC-Wallbox

Public use-case: single or dual outlet



20 - 24 kW

IP 54 outdoor housing

CCS cable, or multi-standard CHAdeMO + CCS

Connectivity, touch screen, RFiD, etc.

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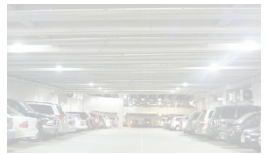	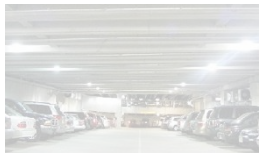		
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Follow the car around the globe

ABB Terra 53 / Terra 54 charger available in 68 countries

EU, NAM, China, APAC, LATAM

Local standards

Local features

Local certification & compliance

Highway and metropolitan segment

Terra 53 / Terra 54: CE-approved 50 kW Multi-standard chargers – Input: 3x 400V

Terra 53/54 CT DC+AC Charger

50kW DC CCS-2

22kW AC

Available

Terra 53/54 CG DC+AC Charger

50kW DC CCS-2

43kW AC (also 22kW version)

Available

Terra 53/54 CJ DC Charger

50kW DC CCS-2

50kW DC CHAdeMO

Available

Terra 53/54 CJG DC + AC Charger

50kW DC CCS-2

50kW DC CHAdeMO

43kW AC

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Highway and metropolitan segment

Terra 53 / Terra 54: CE-approved 50 kW Multi-standard chargers – Input: 3x 400V

Terra 53/54 CG
DC+AC Charger

50kW DC CCS-2

43kW AC (also 22kW version)

Available

Global leader in DC fast Charging

Some examples

EVgo: 550+ Fast chargers

Fortum: 275+ Fast chargers

Lidl: 225+ Fast chargers

Gronn Kontakt: 225+Fast chargers

Estonia: approx. 200 Fast chargers

Fastned: 175+ Fast chargers

CLEVER: 175+ Fast chargers

EnBW: 150+ Fast chargers

E.ON: 150+ Fast chargers

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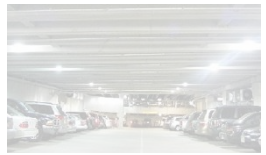	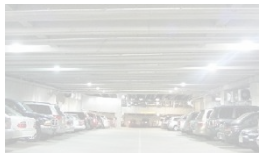		
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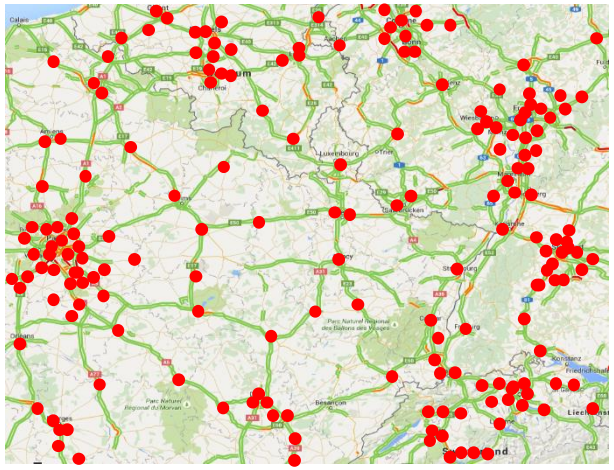
Fast charging: Race for locations started everywhere

Location, location, location

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Public infrastructure	**Race for locations in early markets**			**Race for locations in all key markets**				**Most A & B locations are taken**			

> 2.500 public DC chargers in Europe

> 10.000 public DC chargers in Europe



> Public DC is everywhere

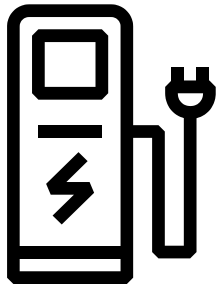
Cumulative EV population estimate EU

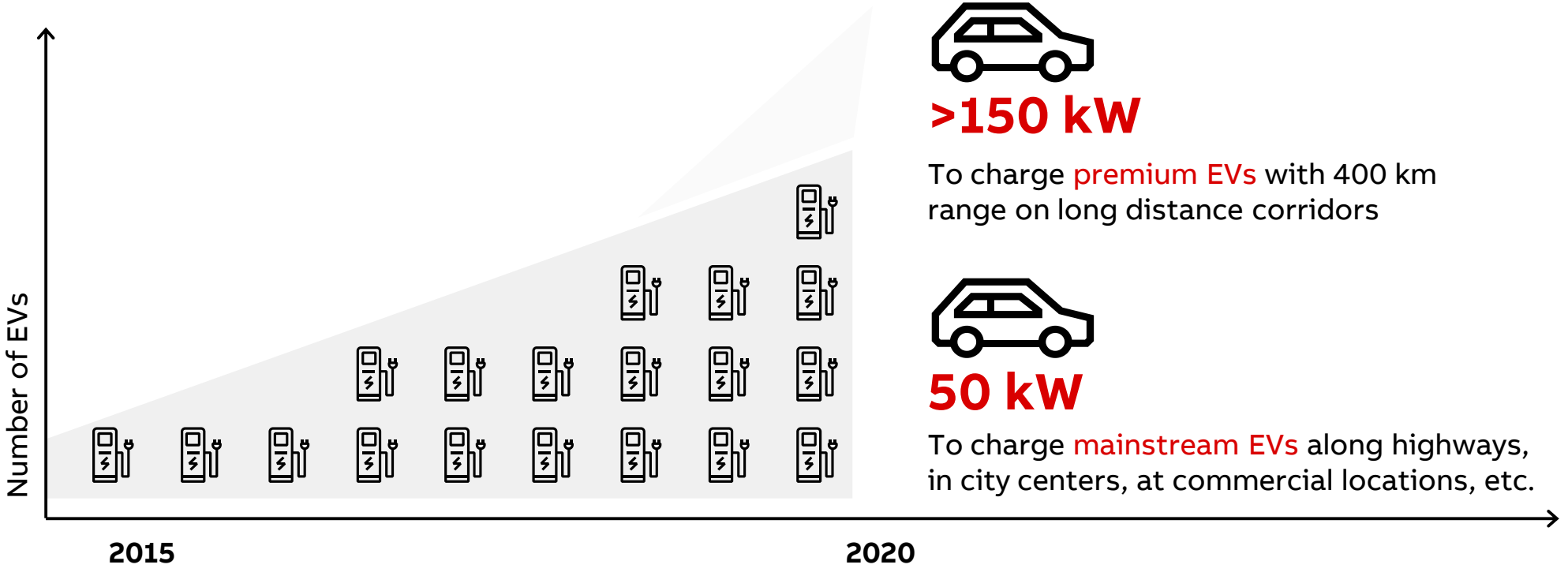
In 2020 the majority of EVs have < 50 kW capability, only small amount of premium EVs

2015

Global trend

The year to secure the best locations for your charging network





>150 kW

To charge premium EVs with 400 km range on long distance corridors

50 kW

To charge mainstream EVs along highways, in city centers, at commercial locations, etc.

The next 5 years, 50 kW chargers will be needed to support mainstream EVs,
Which will be complemented with high power corridors for premium EVs starting 2017

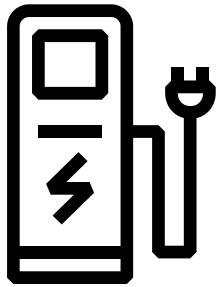
Cumulative EV population estimate EU

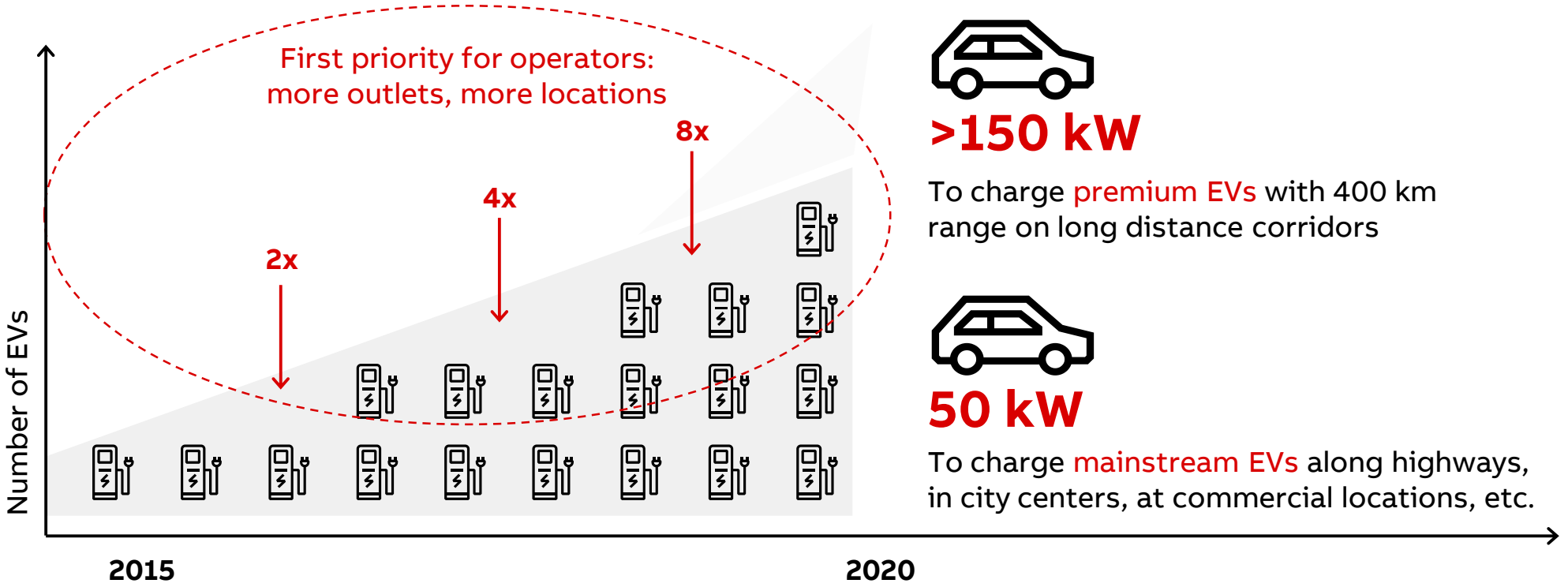
In 2020 the majority of EVs have < 50 kW capability: Increase number of 50 kW outlets

2015

Global trend

The year to secure the best locations for your charging network





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Which will be complemented with high power corridors for premium EVs starting 2017

Different business cases for fast charging

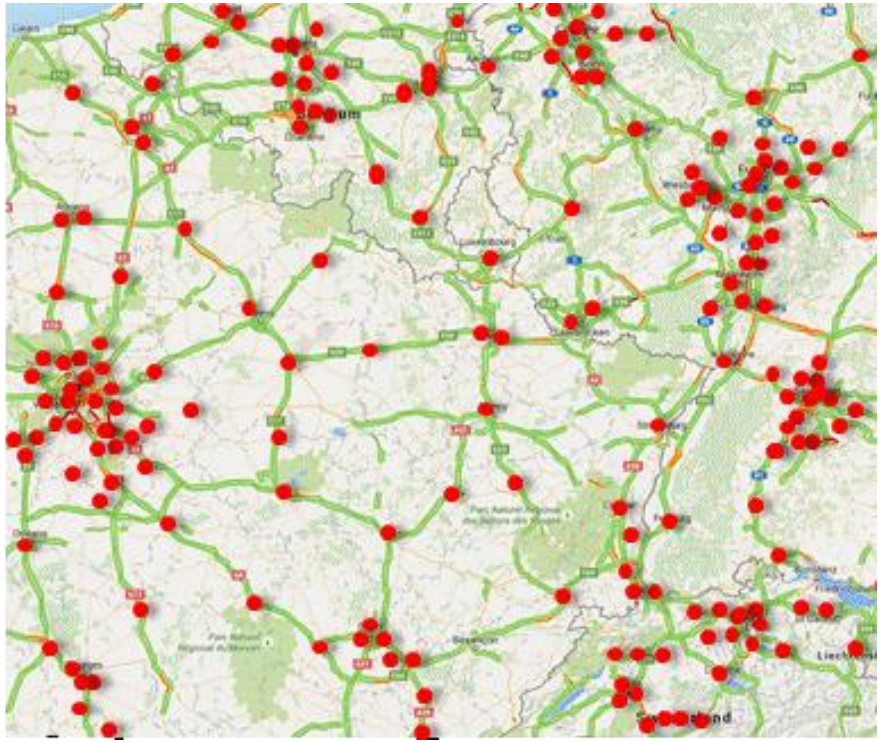
Networks to serve short range EVs will expand fast

2017 and before

Short distance small EVs

100-150 km range

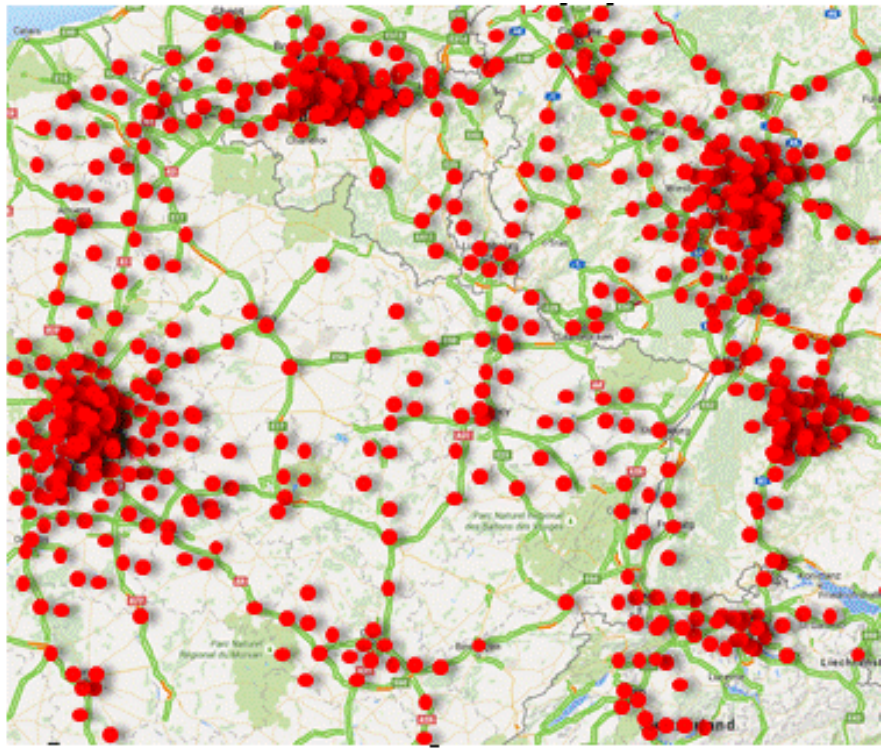
50 kW charging networks are growing



Early 2018

Fast growth of short/ medium distance small EVs (150-300 km)

Higher density 50 kW networks



● = 50 kW fast charger

Different business cases for fast charging

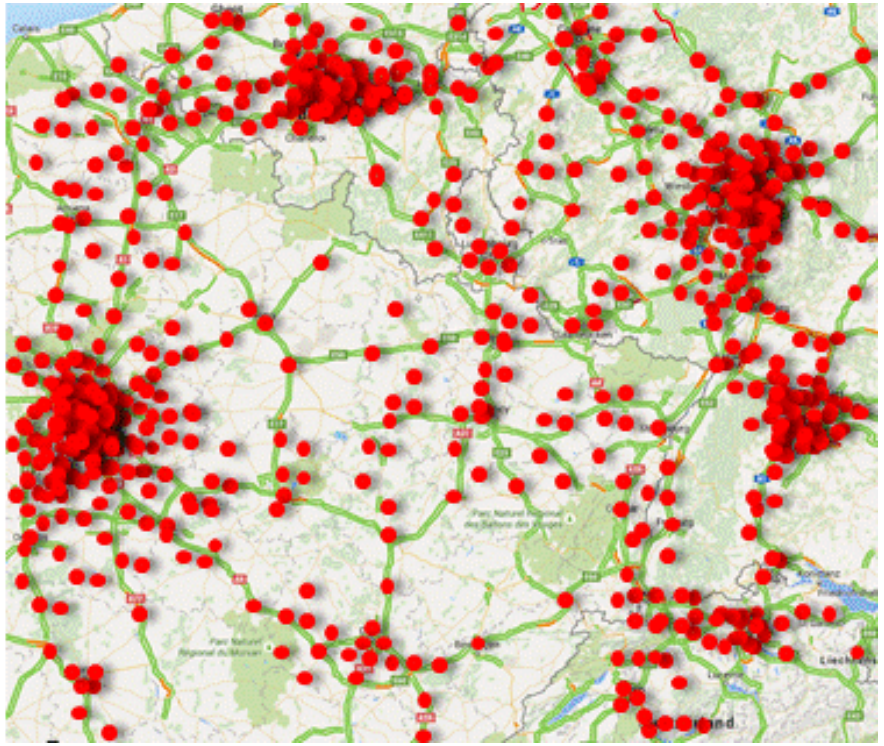
Networks to serve short range EVs will expand fast

Today

Short distance small EVs

100-150 km range

50 kW charging networks are growing



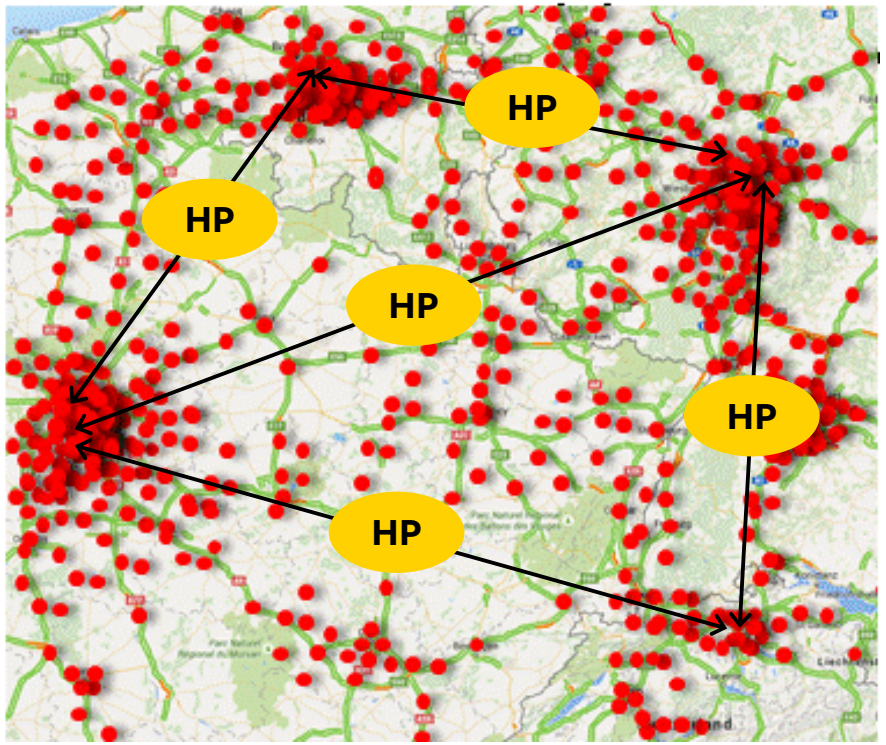
2018 and onwards

Fast growth of short/ medium distance small EVs (150-300 km)

Higher density 50 kW networks

Introduction long distance premium EVs (>400 km range)

High power corridors between cities



● = 50 kW fast charger HP = High power fast charger (>150 kW)

Next generation EV infrastructure market development

With new EVs coming (longer range, faster charging) different use cases will emerge

High Power Charging 150-350 kW

375 A/ 500 A

High speed– short stay

10-20 minute use cases

- Long distance corridors
- Highway rest stops
- Petrol station area's
- City ring service stations

Regional fast charging 50 kW

125 A

More chargers per site – Longer stay

20-90 minute use cases

- Metropolitan locations
- Retail & food locations
- Shopping area's
- Supermarket locations
- Inner-city fast charging
- City ring service stations
- Fleet/ taxi solutions
- Solution for small EVs with <50 kW charging capability

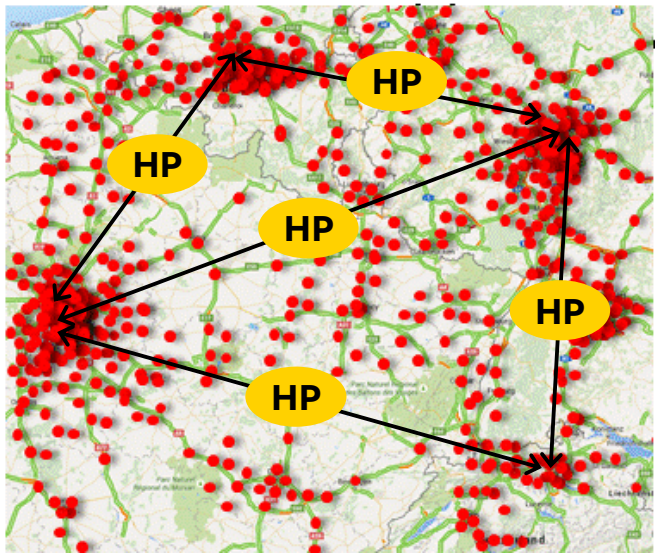


ABB Actively engaged in the new high power CCS standard

CharIN core member from the start

CharIN is the organization to develop high power CCS (150-350 kW)

Wide coalition of automakers support (BMW, VW, Audi, Porsche, Ford, Opel/ GM, Daimler)

ABB was core member of the organization from the start

CharIN e.V.

CCS AT

HOME

CharIN e. V. welcomes member ABB

CharIN e. V. is happy to announce that ABB B.V. has been granted core membership in the association on 12th of November 2015. ABB B.V., which is based in the Netherlands, has joined CharIN e. V. as the first non-German member.

ABB

ABB is leading with Internet-based charging infrastructure, supporting all EV charging standards. ABB offers a total solution: specific charging solutions for any location type and connected services to enhance your business. The chargers easily connect to any service or payment application.

ABB's Internet connected chargers enable fast global service and pro-active maintenance. ABB has years of experience in creating, installing and maintaining charging infrastructure, including several nationwide charger networks.

ABB markets several charging stations which support the CCS standards.

We offer a warm welcome to our Dutch colleagues and look forward to shape the future of CCS together.

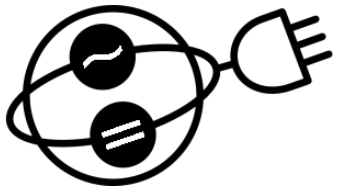


ABB Actively engaged in the new high power CCS standard

CCS standard changes required for power >150 kW

CCS today	New high power CCS proposal
CCS connector	Special CCS connector, backward compatible with today's cars
200 – 500 V_{DC}	Up to 920 V_{DC}
200 A_{DC}	350/ 500 A_{DC}
Up to ~80-90kW charging power	160kW – 350 kW charging power
↓ **CE / UL charger certification based on today's standard**	Power electronics cabinet parameters under review – Current – Voltage – Safety concept – Isolation concept – Electro Magnetic Compatibility (EMC) – Power quality – Accuracy
	Update of IEC standards takes until 2018/ 2019

Standard	Specification (today)	Max charging power for EV car
CHAdeMO	50-500V, 125A	~50 kW
CCS	200-500V, 200A	~80-90 kW

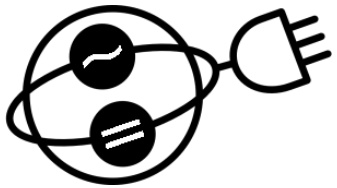


ABB High power charging 2018-2025

Towards 15 minute charging – 400 km/ 250 Mi driving

Terra 54

Terra HP – 1 cabinet

Terra HP – 2 cabinets

50 kW → 3½x more power → **175 kW_p**

175 kW_p → 7x more power → **350 kW_p**

125 A → 3x higher current → **375 A**

375 A → 4x higher current → **500 A**

ABB High power charging 2018-2025

Toward 15 minute charging – 400 km/ 250 Mi driving

Current specification, subject to standardization

Operating voltage range:	CCS:	200 – 920 V_{Dc}
	CHAdeMO:	150 – 920 V_{Dc}
Current:	CCS:	375 A (with 1 power cabinet)
		500 A (with 2 power cabinets)
	CHAdeMO:	200 A
Max. peak power level:	CCS:	350 kWp (160 kW continuous - 175 kWp per cabinet)
Charging cable & connector:	CCS 1&2:	Small diameter, active liquid cooling
	CHAdeMO:	conventional

High Power Charging: non-liquid cooled CCS cables – first public installation

Fastned, the Netherlands - February 2018

ABB selected by Electrify America

to provide high power electric vehicle chargers across the United States

ABB has been selected to supply its Terra HP charging stations as part of the biggest electric vehicle infrastructure project to date in the United States.

The chargers, which can refresh even the largest electric vehicle battery in under 15 minutes, were selected for deployment by Electrify America, which plans to place several hundreds of charging stations within and around 17 metropolitan areas and along multiple nationwide highway corridors.

Creating a national network of fast charging stations – the EV equivalent of fueling stations – is considered crucial for widespread adoption of electric cars in the United States.

The Terra HP, which can operate at powers of up to 350 kilowatts, is able to add almost 200 miles (320 kilometers) of range to an EV in a time frame not much longer than needed to refuel a gas engine vehicle.

ABB's Terra HP chargers are compatible with both the CCS and CHAdeMO DC fast charging standards, enabling drivers to buy the electric vehicle of their choice with confidence that it will work at all of Electrify America's charging sites.

Electrify America switches on the first 350 KW Fast Charging station

Chicopee, Massachusetts, USA / May 3rd, 2018

350 kW CCS

Electrify America switched on it's first of its planned 350 kW CCS Fast Charging stations

Liquid cooled cables in public space

Four parking slots being served by four charging units:

- Unit 1: CHAdeMO or 150 kW CCS-1.
- Units 2 and 4: dual headed 350 kW CCS-1.
- Unit 3: dual headed 150 kW CCS-1.

The dual headed CCS units can charge one car at the time.

IONITY selects ABB as Technology Partner

June 21st, 2018, Munich

IONITY will implement and operate a network of approximately 400 fast charging stations across 24 European countries by 2020.

In addition to the five pilot sites, After successful initial installations, ABB has been selected as the main technology partner and supplier for charging systems by IONITY.

Michael Hajesch, Managing Director at IONITY said he is “glad to have a strong and international technology partner with ABB to drive e-Mobility to the next level across Europe”.

Terra HP Series: 350 kW dual output

Ultra high output current & ABB's unique **Dynamic DC** feature

Ultra high output current

- 375 A per 175 kW cabinet
- 2 x 500 A dual configuration
- Can charge cars with both 400 V_{DC} & 800 V_{DC} drivetrain at maximum power

Dynamic DC feature

- **Dynamic DC** power allocation delivers power dynamically to multiple outputs
- Create a multi-output charging site in a highly cost-efficient way

350 kW
500 A
150-920 V_{DC}

350 kW
500 A
150-920 V_{DC}

Terra HP Series: Static and Dynamic DC configurations

Single output or 350 kW dual output with ABB's unique **Dynamic DC** feature

175 or 350 kW Single Output Terra HP Static

175 KW
350 A

350 kW
500 A

350 kW Dual Output Terra HP Dynamic DC power allocation

150-920 V_{DC}

Dynamic DC: patented by ABB

350 kW
500 A

350 kW
500 A

Power expansion

1 cabinet expansion

2 cabinet expansion

ABB Terra CP500 Gen2 charge post

Modular charge post platform (500 A): Expected November 2018

Modular charge dispenser

- Single CCS version
  - CCS-1 or CCS-2: 500A/ 920V capability, liquid cooled cable
- Multi standard CCS + CHAdeMO version
  - CCS-1 or CCS-2: 500A - 920V capability, liquid cooled cable +
  - CHAdeMO: 200A/ 500V capability, non-liquid cooled cable
- 7” touch screen
- Programmable RGB LED strips + white LED top light
- Customer replaceable top insert
- DC metering prepared
- Dimensions (D x W x H in mm): 440 x 620 x 2390 mm

Payment solutions

- Creditcard terminal for EU & USA (in later phase)
- RFID (Mifare, Calypso, etc.)
- PIN code access

Charge post customization

Supporting brand identity

Top light

– White LED up-light illuminating the top styling element.

Programmable LED strips

– Vertical RGB LED strips on both sides of the front door.

– Colors can be set via the back-end to match customer branding.

Top styling element

– Top styling element can be removed and replaced in the field by own design or same design in a different color (by customer).


ABB

Programme

Driving the future of e-mobility

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SMARTER MOBILITY

Bus and Truck Charging Infrastructure

ABB Electric Vehicle Infrastructure Forum 2018

Wim Elshout, Global Sales Manager, EVCI, ABB

The eBus market is ready to go

Press release

VOLVO BUSES RECEIVES ORDER FOR 90 ELECTRIC BUSES FROM BELGIUM

2/9/17

Press information

Volvo Buses has secured its largest ever order for complete solutions The Belgian cities of Charleroi and Namur have together ordered 90 Vo Hybrid buses as well as 12 charging stations. The buyer is public trans Group. The charging stations will be delivered by ABB.

ABB supplies chargers for Norway's large electric bus fleet

March 07, 2018 // By Nick Flaherty 0 Comments

Email print Share Share reddit G+

ABB is to supply eight Heavy Vehicle Chargers (HVCs) in Trondheim, Norway, to power a fleet of 35 fully electric vehicles in one of Europe's largest electric bus schemes.

The project for Trøndelag County Council is one of the first projects where fully electric buses of two different bus brands will run a large

Canada Sets the Course with Zero Emission Demonstration Trial

MASS TRANSIT

BY MAUREEN SHUELL ON AUG 10, 2017

art of this project, at least 20 electric buses supplied by New Flyer Industries and Nova Bus Inc., along with

BUSES WITH BATTERIES

One city in China has more electric buses than all of America's biggest cities have buses

Canberra (Australia) Now Home To Electric Bus Route

Facebook Twitter G+ Google+ Pinterest

August 27th, 2017 by **James Ayre**

The Australian city of Canberra is now home to its first all-electric and hybrid buses, following the launch of a new 12-month public transportation fleet trial last Monday.

*Photo by **Rohan Thomson***

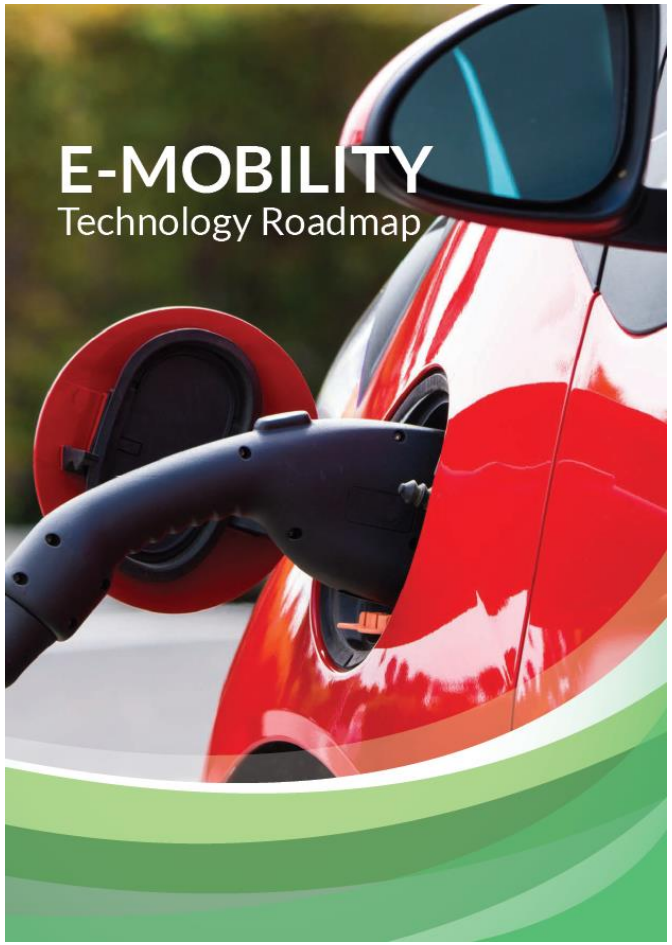
The eBus market is ready to go

EU Requirement

“All city buses should have zero emission capabilities by 2030”

The eBus market is ready to go

SG Roadmap



E-MOBILITY – Technology Roadmap
Technology roadmap on electromobility until the year 2050

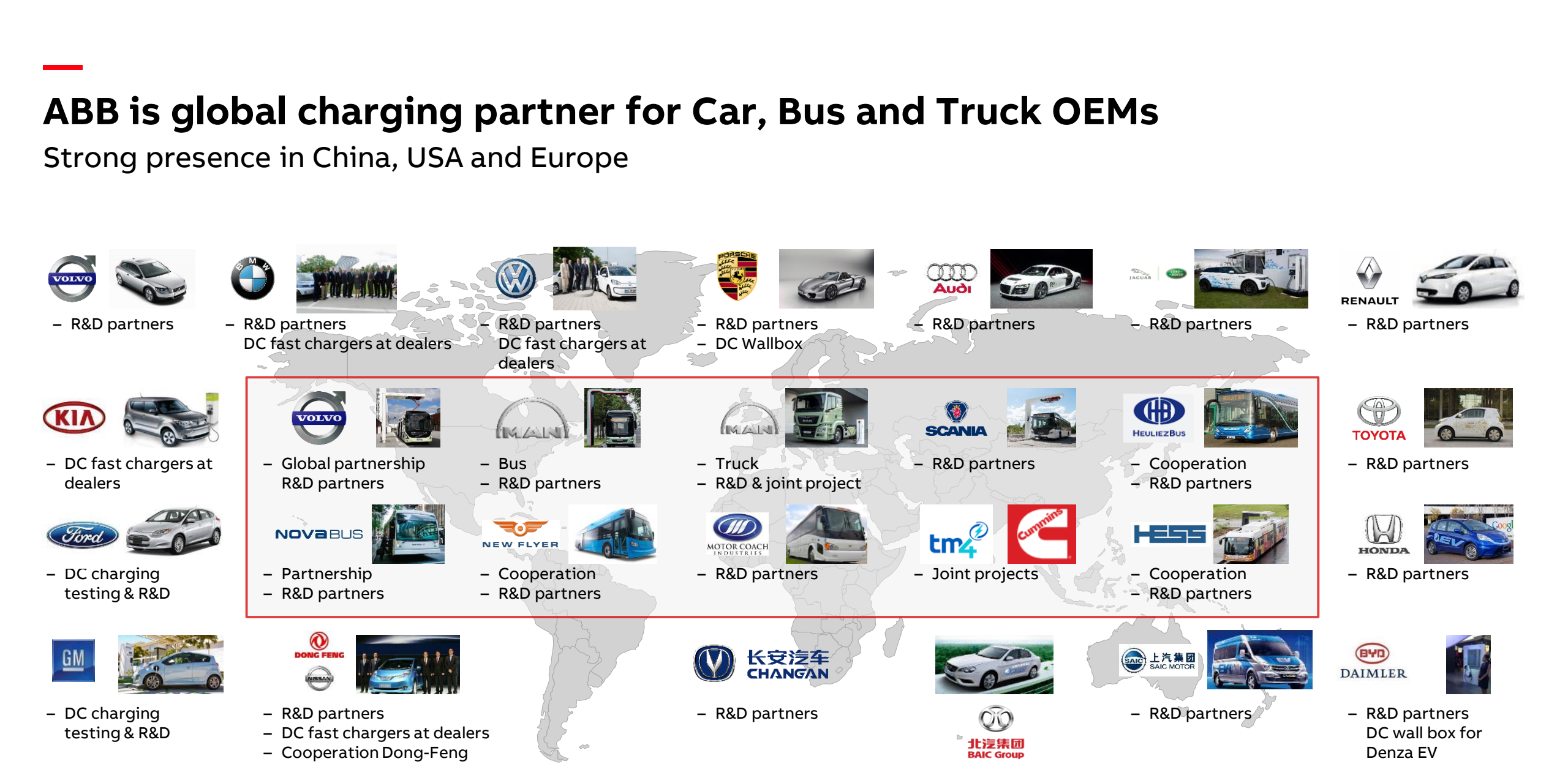
- The National Research Foundation (NRF)
- National Climate Change Secretariat (NCCS)
- The Land Transport Authority (LTA)
- Energy Research Institute (ERI@N) of Nanyang Technological University (NTU)

"Electrification between 134,000 EVs (Low scenario) and 532,000 EVs (High Scenario) in 2050. **Public Buses** and taxis offer the biggest potential for electrification"

The eTruck market is ready to go

ABB is global charging partner for Car, Bus and Truck OEMs

Strong presence in China, USA and Europe



Reference project: TEC in Namur & Charleroi, Belgium

101 Electric Hybrid buses & 15 Opportunity chargers

100+
electric hybrid buses are charged by ABB fast chargers in the cities Namur and Charleroi in Belgium

15
DC fast chargers installed in Namur and Charleroi based on open interface OppCharge

16
year service contract to ensure reliable operation during the entire lifetime of the project

15
electric substations and switchgear from ABB to power the chargers

150 kW
per charger

90%
of Namur's city bus routes to be served by electric hybrid buses

Electric Hybrid
equipped with an electric motor, batteries and a small diesel engine

70-90%
lower emissions of carbon dioxide compared with a conventional diesel bus, depending on the fuel used

60%
lower energy consumption than a corresponding diesel bus

Quiet

ABB to energize Singapore’s autonomous electric bus project

Singapore, January 11, 2018

300 kW OppCharge

Nanyang Technological University, Energy Research Institute

Volvo and NTU will build the autonomous driving solution on Volvo’s platform

Two autonomous driving electric buses in 2019

ABB Recharges the batteries in 3 to 6 minutes

MAN Truck & Bus

R&D partner and charging partner for eTruck project in Austria

- Chargers for R&D and testing facilities Bus & Truck
- Charging partner in MAN e-truck project CNL, Austria
- Custom design charge pole for:
  - IAA Hannover 2016

Global partnership agreement Volvo and ABB

Global partnership agreement Volvo and ABB

- Agreement to deliver ABB chargers for Volvo worldwide
- Based on open industry interface
- Chargers at Volvo Bus HQ in Gothenborg, Sweden for:
  - Integration testing and validation
  - Duration and reliability testing
  - Customer demonstration

SMARTER MOBILITY

Depot charging

Overnight charging

With CCS-2 connector + cable

Terra 54C HV

HVC 100C

HVC 150C

- Industrial quality power cabinet
- 50kW, 100kW & 150 kW
- 50 and 100kW field upgradable
- Redundancy from 3 x 50kW power module
- Cable with connector (max. 200A DC)
- 200-920 V_{DC}
- Open industry standards:
  - CCS-2
  - EN/IEC 61851-23
  - ISO/IEC 15118

- Remote management and support

Overnight charging 50 kW- 150 kW

ABB’s field upgradeable system is future proof

HVC 100C

Upgrade

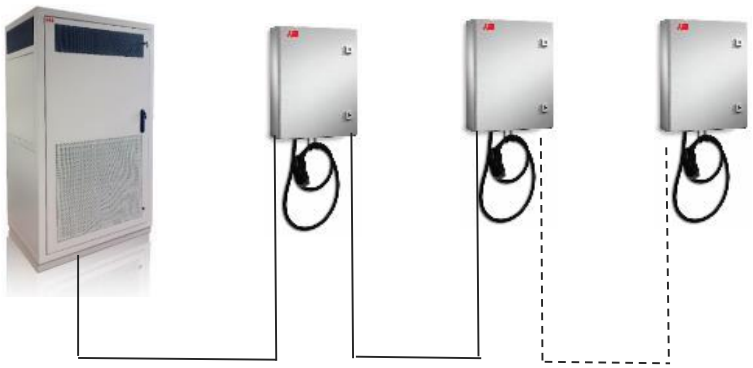
HVC 150C

Upgrade can be done in the field by adding an extra module.
No groundworks, digging and disturbance to the site required

More busses with large battery capacity in the fleet

2017	2018	2019	2020	2021	2022
> 100 kWh	> 200 kWh	> 300 kWh	> 400 kWh	> 500 kWh	

Sequential charging - How does it work?



- 3 busses share one 150 kW charger.
- Each bus has a dedicated charge box.
- When buses arrive they each plug in to their respective depot charge box
- Buses can remain connected also after charging has finished.

1. First Bus 1 starts charging with 150kW full power, using charge box 1. When bus 1 is full it stops charging.

2. Then Bus 2 charges with 150kW until full. Charging stops.

3. Finally Bus 3 charges with 150kW until full. Charging stops.

SMARTER MOBILITY

Opportunity charging

The ABB offering

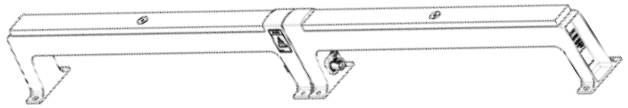
What is OppCharge?

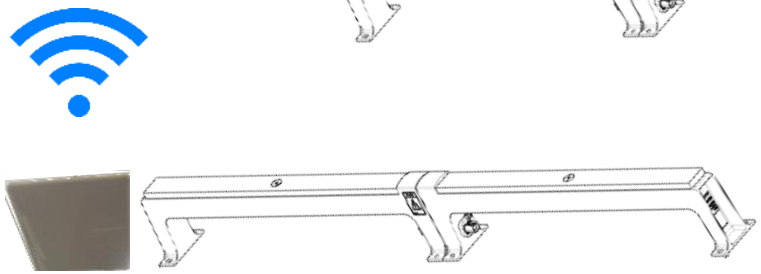
An easy-to-implement open interface

offboard

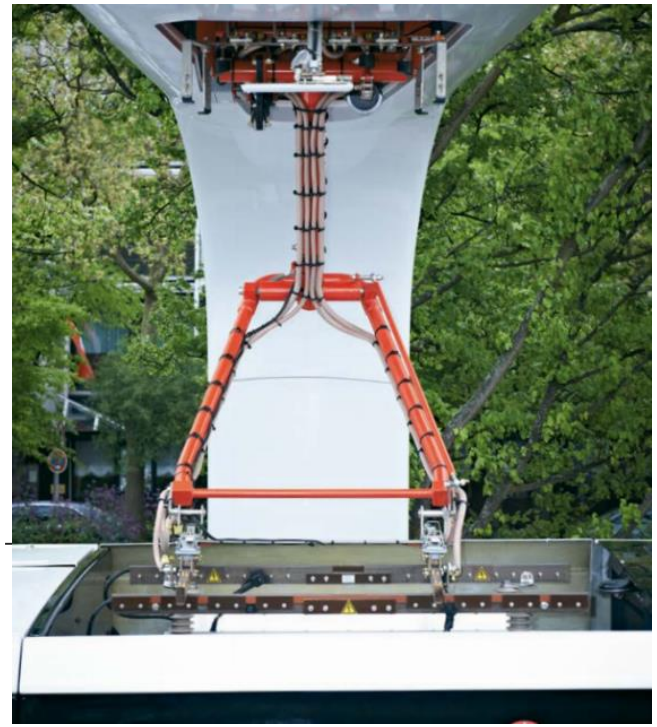
onboard

4-poles: plus, minus, ground, pilot





OPPcharge



Charging is done according to:

- EN/IEC 61851-23
- ISO/IEC 15118
- DIN70121

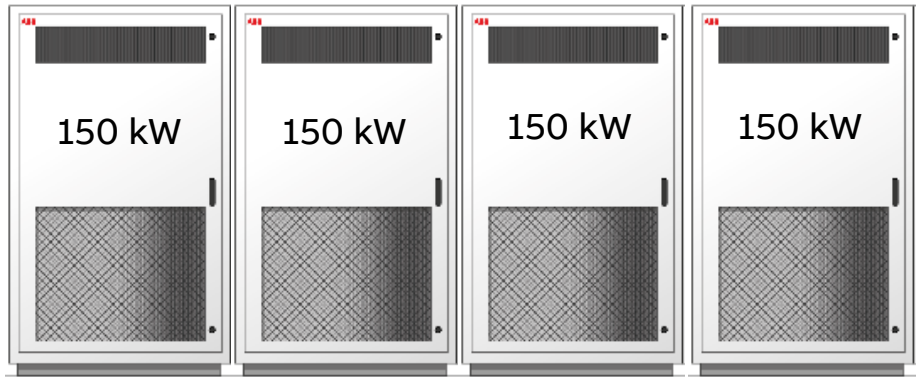
(aka CCS-2)

Opportunity charging

Reliable, scalable, based on industry standards

- Industrial quality power cabinet
- 150kW, 300kW, 450 kW and 600 kW modular
- Redundancy per each 150kW module
- 200-920 V_{DC}
- Galvanic isolation
- Remote management

- Automated connection system
- High power DC transfer to bus
- Wireless communication to bus
- Based on
  - EN/IEC 61851-23
  - ISO/IEC 15118
- OPPCharge compatible



Support of inverted pantograph growing rapidly

VOLVO OPPCharge

MAN

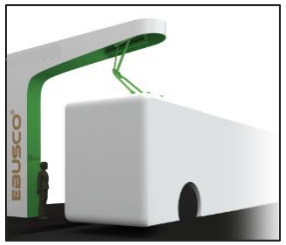
SCANIA OPPCharge

NEW FLYER OPPCharge

NOVA BUS OPPCharge

SOLARIS OPPCharge

VANHOOL



EBUSCO OPPCharge

Linkker

HEULIEZBUS OPPCharge

HESS OPPCharge

IVECO BUS OPPCharge

VDL BUS & COACH

?

Bus depot charging vision - example

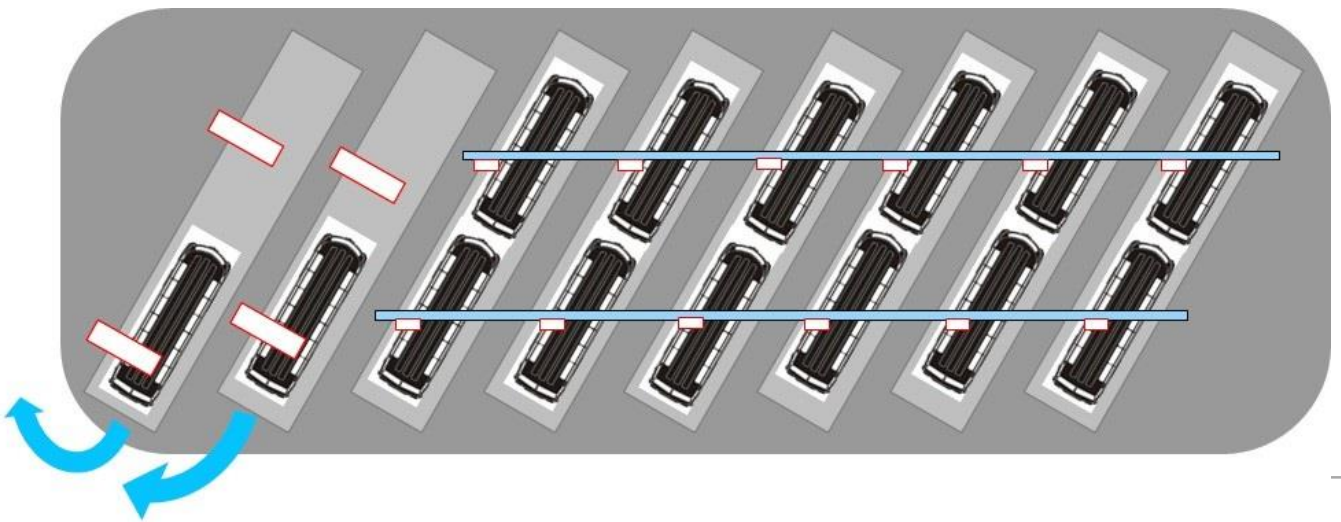
Basic idea, offering flexibility, reliability & redundancy

High speed lanes
flexibility & incident recovery

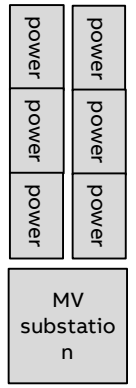
Automated Pantograph solution
(300- 600 kW)

Normal lanes
main (overnight) charging operation

Overhead portals with CCS cable
(50-100-150 kW)



Power area
Modular charging systems at convenient location




ABB

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SMARTER MOBILITY

ABB Ability™ and Connected Services for EVCI

ABB Electric Vehicle Infrastructure Forum 2018

Wim Elshout, Global Sales Manager, EVCI, ABB

Connected services

Connectivity is needed to

Monitor and operate a network of chargers

Get paid for a charge session

Help EV-drivers in case of questions

Maintain and service a charger at lowest cost

Reliable 24/7 connectivity is fundamental for a commercial operation of a network of chargers!

Digital integration of an ABB EV charger

ABB's solution

Highly redundant cloud platform

Extended protocol to the charger

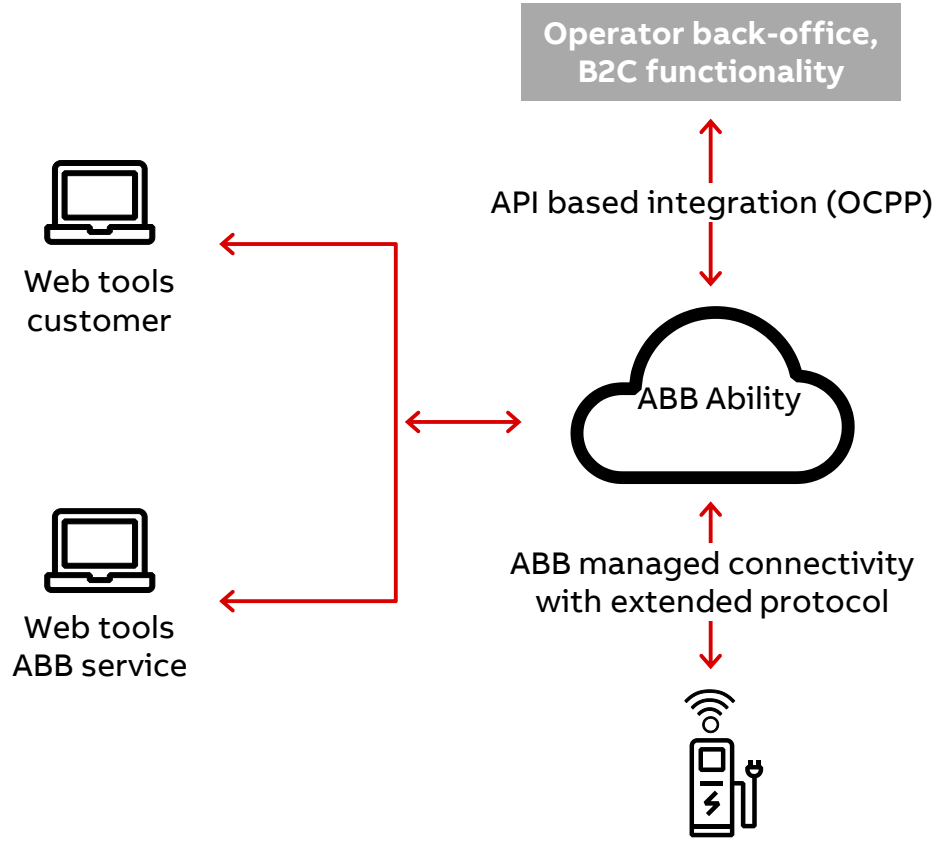
Over 7,500 chargers connected

24/7 network operation center, enforcement of SLA with GSM provider, outage mitigation & resolution

SW updates and car interoperability updates

Advanced remote service concept (by ABB or 3rd party)

APIs & web tools available based on a SaaS model



Providing access to a charger

Via RFID cards and/or Mobile phone APPs

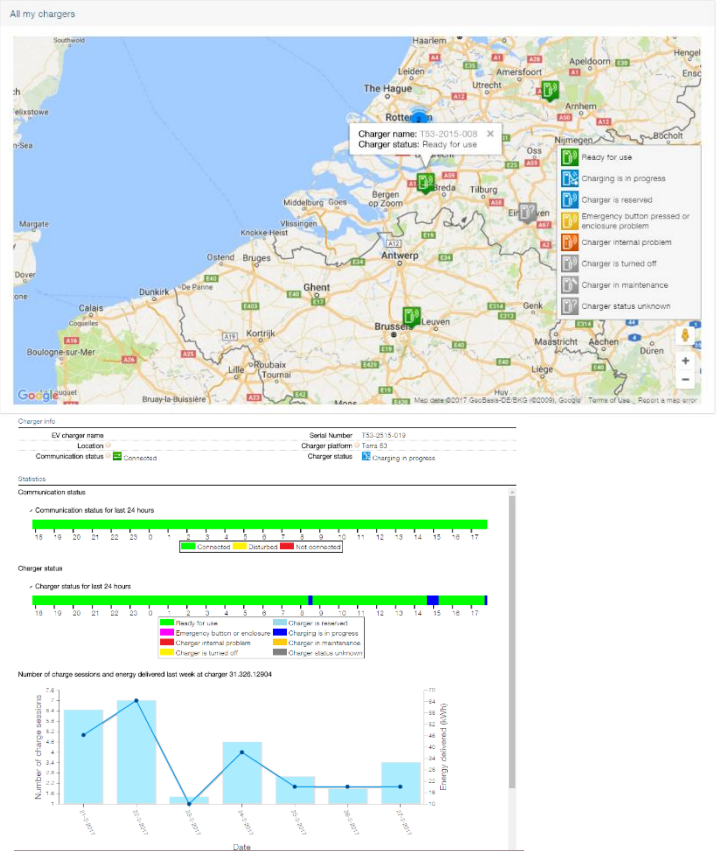
ABB provides the commands (like start/ stop charger) and information (like progress) for the App.

ABB does not build the App., nor provides RFID cards

ABB ensures integration between charger and IT-systems

Web tool – Driver care

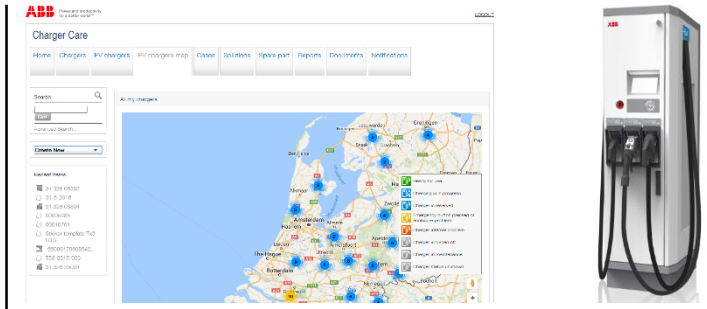
Benefit	Understand network status and how it is used Manage access without using OCPP Improved EV driver satisfaction due to a fast & competent driver support
Main features	Monitoring status of network and on EV charger level Gain insight by standard reports Customer export of complete data sets Access management – PIN and RFID card management Solutions & Cases – Diagnosis and repair guidelines – Escalate cases to ABB Service in tool Notifications Works for all products (past, now and future)



Web tool – Charger care

Advanced diagnosis

Benefit	Reduced time to repair → charger uptime Efficient and optimized own service operation Improved service level of network due to optimized charger support
Main features	Remote monitoring and advanced diagnostics features – Charger network overview – Status & statistics on charger level – Real time insights on component level status, parameters and HW versions Access to advanced settings and remote action – Changing parameters and configurations – Rebooting individual boards Online spare part information (ordering via LSUs) Access to solution library and technical documentation Case management and automatic notifications For Terra 54, Terra 53, Bus, Wallbox and HPC (not for T51)
Requirements	Can only be operated by ABB certified service engineers



outlets

outlet parameter	1 - AC_CABLE	2 - CHADEMO	3 - CCS
outlet status	AVAILABLE	AVAILABLE	AVAILABLE
last failure	No Authorization device	No Authorization device	No Authorization device
cpi board	CPAB-365	CPJB-325	CPCB-930
imi board		IMI-1448	IMI-1382
cable status	Not connected	Not connected	Not connected

box checks

All box checks ok

outlets

outlet parameter	1 - AC_CABLE	2 - CHADEMO	3 - CCS
outlet status	ERROR	AVAILABLE	AVAILABLE
last failure	Charger temperature error		
cpi board	CPAB-987	CPJM-0	CPCB-4294967295
imi board		IMI-848	IMI-726
cable status	Connected	Not connected	Not connected

box checks

box check identifier	value	update time
Boards/CPIAc/Boxchecks	failed	6-12-2016 14:14
Boards/CPIAc/Boxchecks.ChargerTemperature	Charger temperature too high	6-12-2016 14:14

Payment solutions for ABB DC Fast chargers

Payment terminal

Main features

Payment via credit card and NFC

Low operational and transactional costs

Field upgrade for any Terra 54, Terra 53, Terra 24 and Terra 23

Payment upfront per charging session

Automatic cancellation of payment in case of problems during first minutes of charging

Operator control via ABB Web modules

– Setting price per outlet

– Transaction overview (successful and canceled ones)

Default RFID functionality can be maintained

Customization of charger's display / User interface

Currently, the software platform includes the following features of basic customization

Include a custom screensaver with user explanation, payment plan information, marketing & promotion, advertisement messages, etc.

Replace the logo in the screen by the operator's logo

Insert your own banner (top part of the display), which may consist of e.g. the customer's logo and some text lines, providing a help desk number, website link, icons of allowed credit cards, etc.

Change most of the texts used in all screens, buttons, toolbar, help menu's etc. Create a multiple language option

Network Operations Center (NOC)

Proactively monitoring status of chargers

Advantages of ABB Connected Services Platform

Reliable connectivity

24/7 monitoring of network status

Remote software updates

Compliance with communication standards/ OCPP

Service & Support

EVI Global Service

Charger care

Why is Proactive monitoring needed?

- ABB is constantly monitoring over **400 parameters** of every charger
- ABB is able to diagnose more than **90%** of the service cases remotely
- Solving over **60%** of these cases without any on-site intervention.
- Identifies the issue and reports automatically
- Savings on down-time, travelling, transportation, man-hours and resources

EVI Global Service

Service concept

Global Technical Support network operation center

Global Technical Support

Develop solutions and offers based on experience from 5000+ chargers serviced world wide

Support all escalated cases with ABB web Modules

Located in The Netherlands

Local Service ABB

Local Technical Support

Responsible for SLA

Support all charger related cases with ABB web Modules

Escalate cases to GTS

Tools: Helios

Owner, Operator and Service Partner

User and Charger Support

Support all driver and charger related cases with ABB web modules and APIs

Escalate cases to Local Service ABB

Tools: Driver Care, Charger Care, OCPP and APIs


ABB

Q&A

ABB ELECTRIC VEHICLE CHARGING INFRASTRUCTURE FORUM 2018

Driving the future of e-mobility with ABB

26 September 2018

Thank you for attending the ABB EVCI Forum 2018!