



APRIL 16TH, 2019 | EPSP – EVCJ

EV Infrastructure

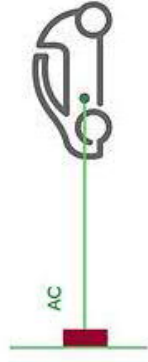
Product Group presentation



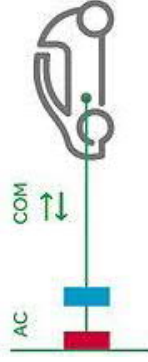
About Chargers

EV Charging Station

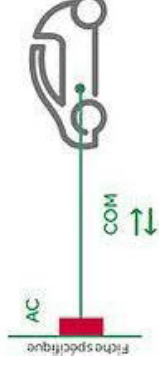
Type of Charging



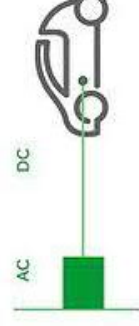
Mode 1 : Domestic socket and extension cord



Mode 2 : Domestic socket and cable with a protection device



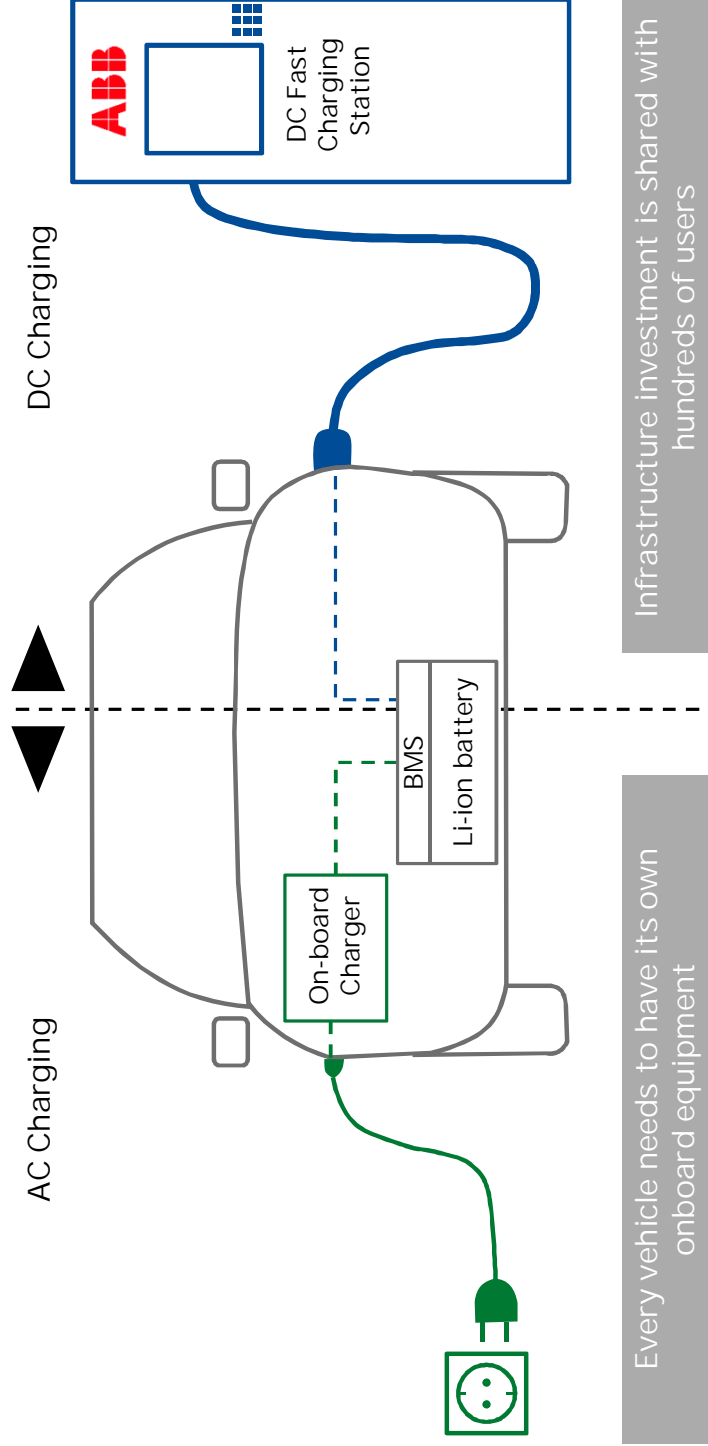
Mode 3 : Specific socket on a dedicated circuit



Mode 4 : Direct current (DC) connection for fast recharging

AC charging versus DC charging

On-board versus Off-board equipment



Only few EVs can charge with 22 kW at an AC charge post

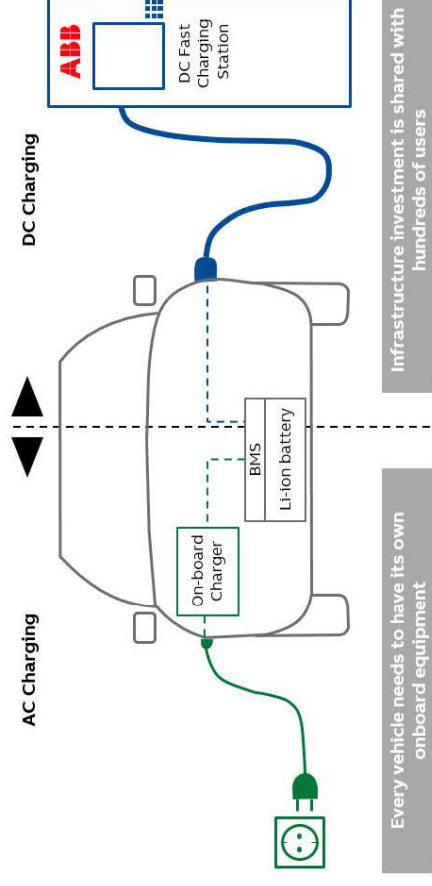
In most cases, the AC charging speed is limited by the EV on-board converter (OBC)

Only a very small amount of EVs can charge at 22 kW:

- Renault Zoe
- Tesla Model S with the optional 22 kW OBC. This was default at the begin but later changed to an 11 kW OBC (cheaper).
- Smart ED, only with the very expensive 22 kW OBC option. Default is a 3 kW to max. 6 kW OBC.
- Audi Quattro e-tron with 11 kW OBC (optional 22 kW OBC)
- Mercedes B-Class which is hardly sold, with 11 kW OBC.

Other BEVs typically AC-charge with 3 kW to max. 6 kW.

The same holds for PHEVs: almost no car can AC-charge at 22 kW.



EV Charging Standard

Primary types of Open charging standard



Slow AC (7 kW)

AC type 2 is mainly used for slow charge single phase upto 7kW destination charging



Medium Power DC (20kW to 50kW)

50kW CHAdeMO public charging is benchmarked for the next 5 years because of the existing installed Nissan Leaf base.



50kW 500V CCS2 will be on every public fast charger for the foreseeable future as this is the most acceptable DC fast charging standard.

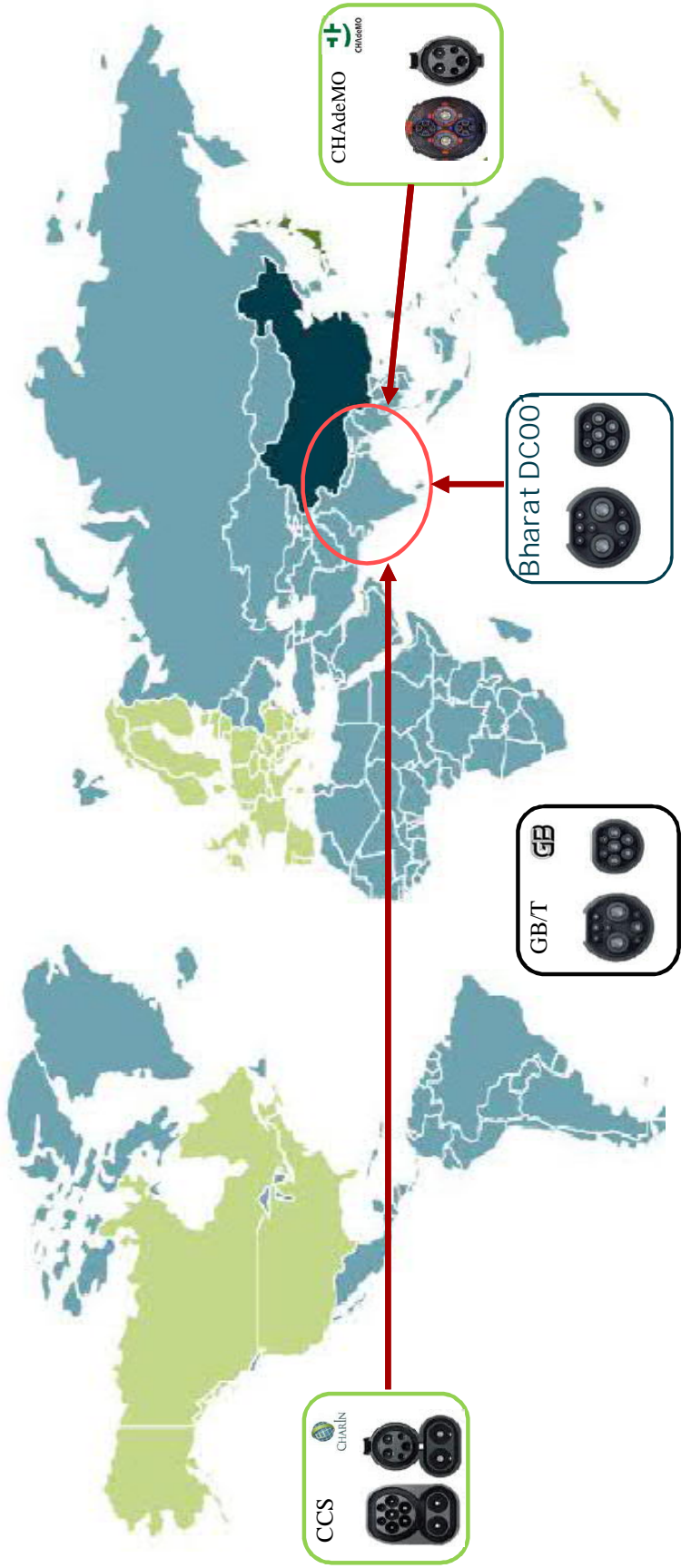


High Power DC (100kW & above)

>150kW 800V CCS2 will enter the market in low volume (starting end 2017) as a successor to existing high volume 50kW 500V CCS2. It will not replace 50kW CCS2.

EV Charging Standards

World is changing



— Market segments & products

ABB EV charging

Mission statement – EV Infrastructure team

We offer AC and DC charging solutions for Electric Vehicles...

...from 3–600kW...



..with cloud connectivity..



...based on standards...



...using ABB technology...



...in all countries...



Present in
69 countries

and ABB manufacturing.



EV fast charging and global standardization

ABB leading in major developments this decade

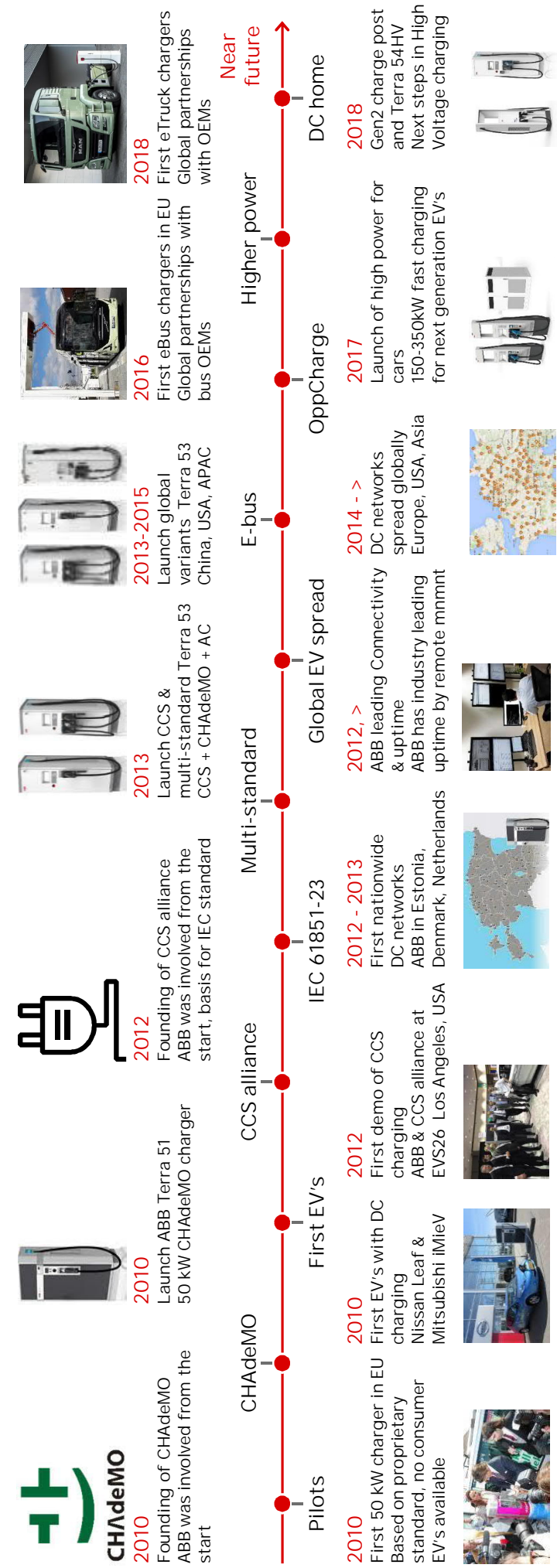


ABB EV Charging Infrastructure

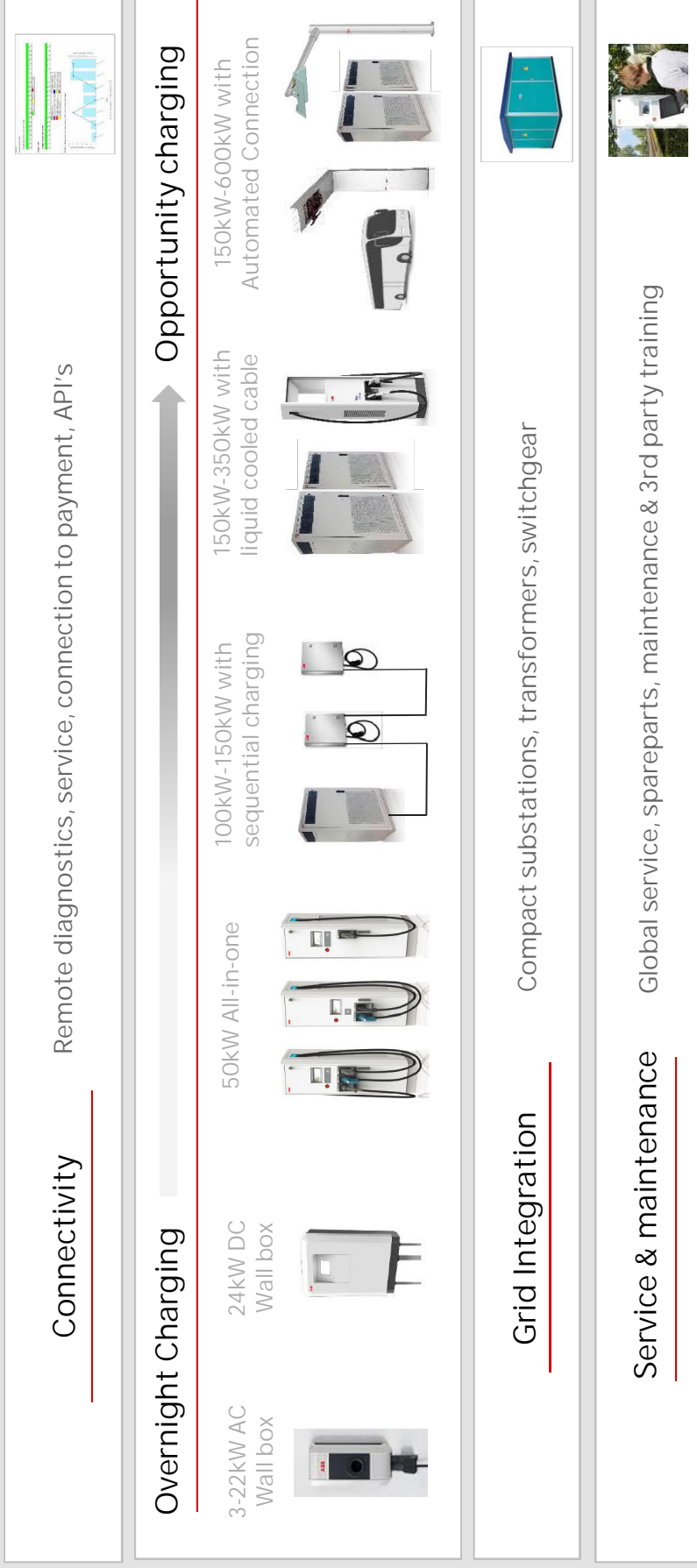
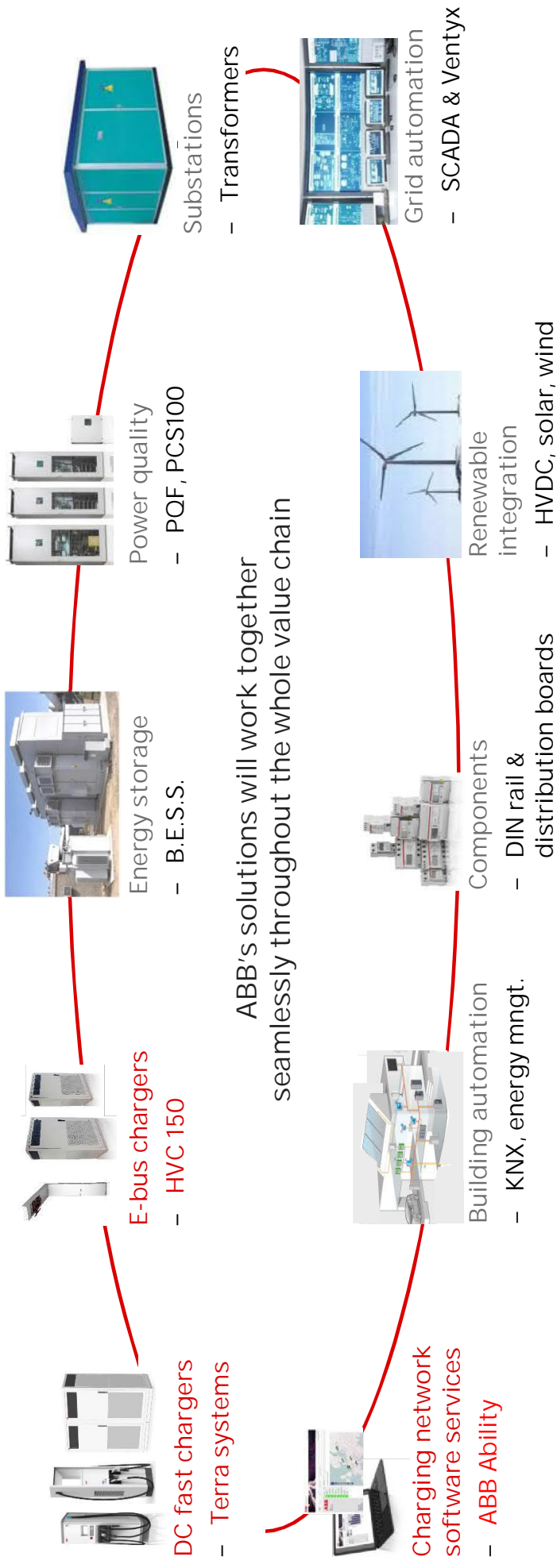


ABB offers solutions for the complete value chain

From power generation to the vehicle



EV Charging Infrastructure Electrical Architecture

Standalone



Building



Station

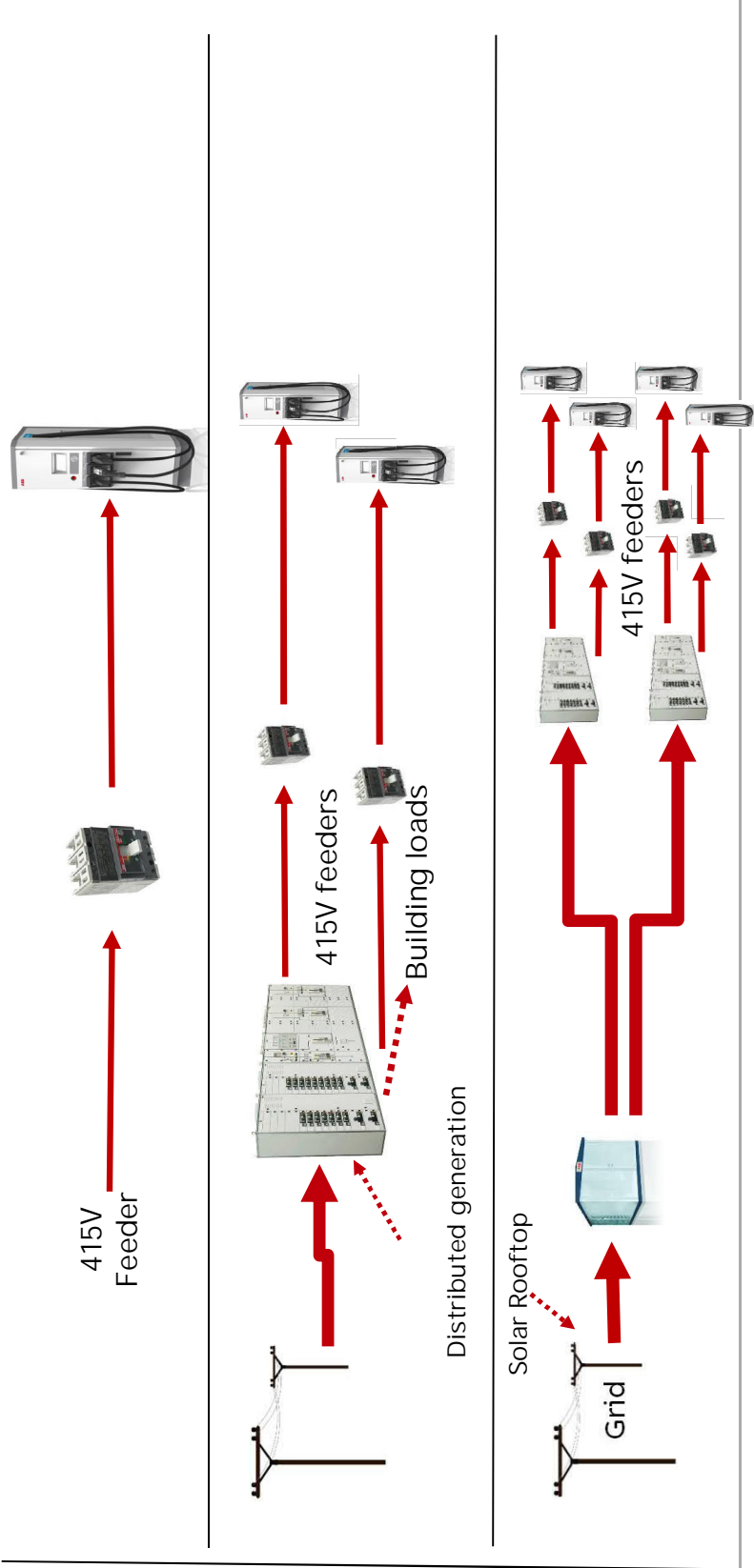


ABB is global charging partner for Car, Bus and Truck OEMs

Strong presence in China, USA and Europe

Global Partnerships:

- VOLVO** - R&D partners
- BMW** - R&D partners
- DC fast chargers at dealers**
- RENAULT** - R&D partners
- TOYOTA** - R&D partners
- HONDA** - R&D partners
- DAIMLER** - R&D partners
- DC wall box for Denza EV**

USA Partnerships:

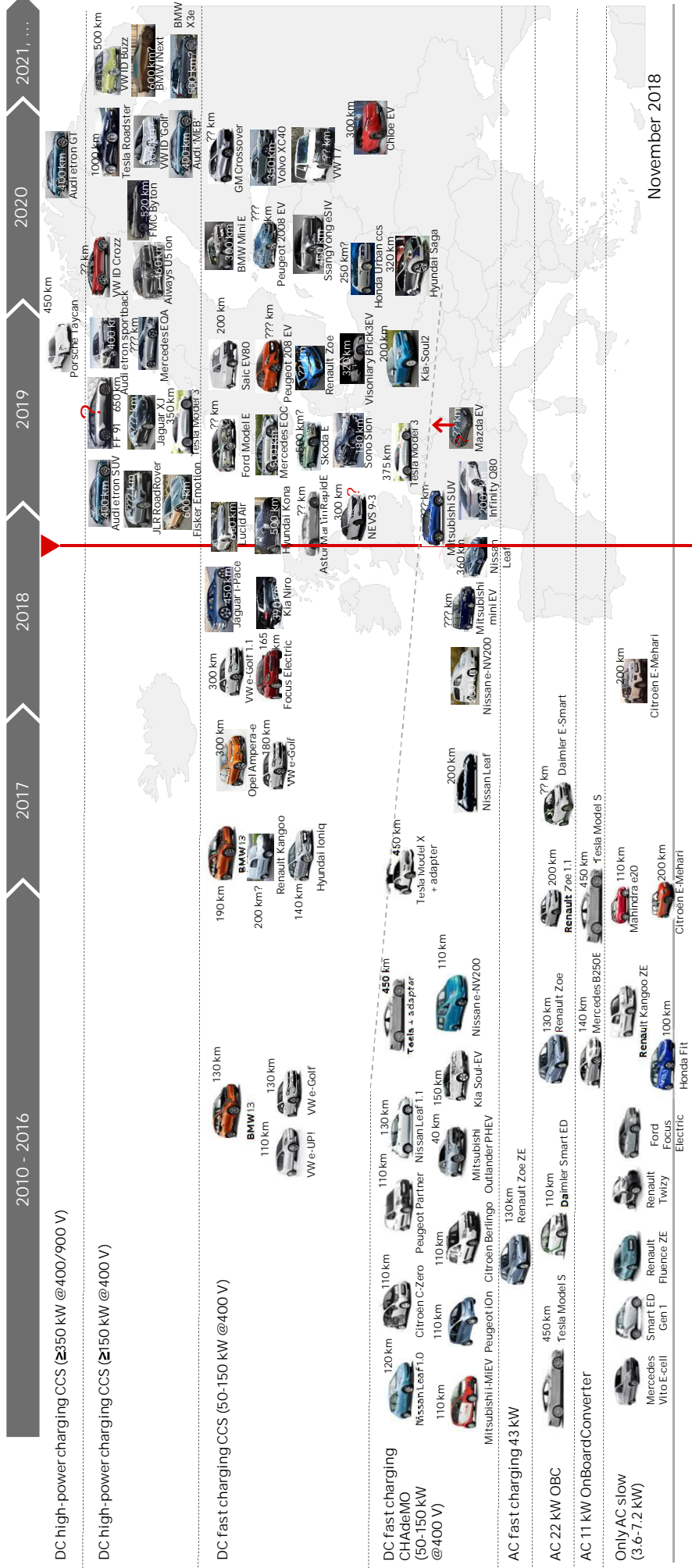
- KIA** - DC fast chargers at dealers
- Ford** - DC charging testing & R&D
- GM** - DC charging testing & R&D
- NOVA BUS** - Partnership R&D partners
- MAN** - Bus R&D partners
- NEW FLYER** - Cooperation R&D partners
- SCANIA** - R&D partners
- MAZDA** - Truck R&D & joint project
- MOTION COACH MANUFACTURING** - R&D partners
- CHANGAN** - R&D partners

China Partnerships:

- HEULIEZBUS** - Cooperation R&D partners
- HESSE** - Cooperation R&D partners
- 上汽集团 SAIC MOTOR** - R&D partners
- 北汽集团 BAIC Group** - R&D partners
- 长安汽车 CHANGAN** - R&D partners
- 北汽集团 BAIC Group** - DC fast chargers at dealers
- Cooperation Dong-Feng**

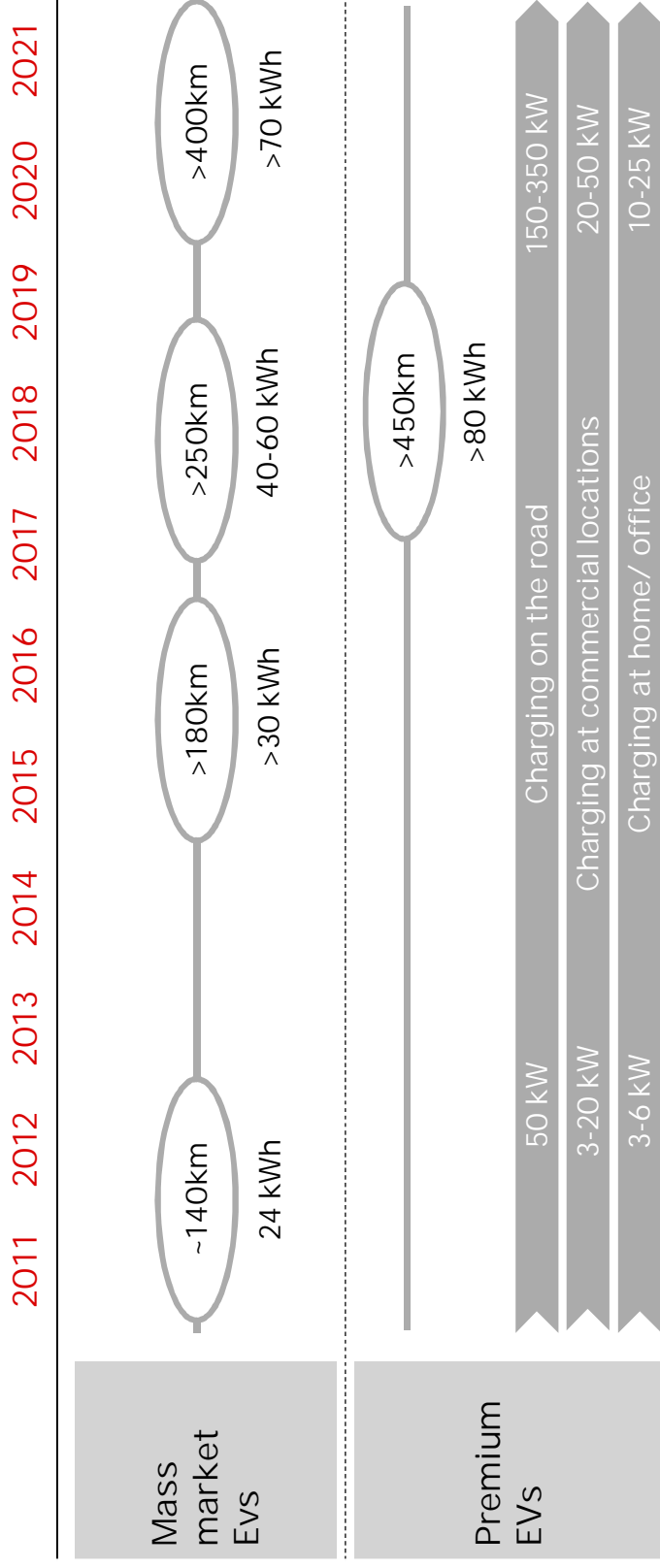
— Market (cars & Products)

Follow the car through Europe, and open standard protocols



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

Batteries get bigger, range gets longer



2W & 3W:
<10 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 application and demand

Public and commercial EV Charging

AC destination	DC destination	DC Fast	DC High Power
3-22 kW	20-25 kW	50 kW	150 to 350 kW+
4-16 hours	1-3 hours	20-90 min	10-20 min



- Office, workplace
- Home
- Multi family housing
- Hotel and hospitality
- Overnight fleet
- Supplement at DC charging sites for PHEVs

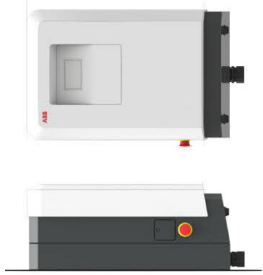
- Office, workplace
- Hotel and hospitality
- Parking structures
- Dealerships
- Urban fleets
- Public or private campus
- Sensitive grid applications

- Retail, grocery, mall, big box, restaurant
- High turnover parking
- Convenience fueling stations
- Highway truck stops and travel plazas
- OEM R&D

- Highway corridor travel
- Metro 'charge and go'
- Highway rest stops
- Petrol station area's
- City ring service stations
- OEM R&D

Public and commercial car charging – Use cases





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Public and commercial car charging – Use cases

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EVLunic AC Wallbox

Portfolio overview

Models

EVLunic B

EVLunic B+

EVLunic Pro

EVLunic Pro M



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

Portfolio details

Options





Outlet type	
	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 4.6 kW - 11 kW (type 2 cable models only) - 22 kW (type 2 models only)
Authentication	<ul style="list-style-type: none"> - None - Key (B+ models only, cylinder can be replaced) - RFID (MIFARE)
UMTS/3G	<ul style="list-style-type: none"> - No - Yes (Pro_M models only)
Pedestals (sold separately)	<ul style="list-style-type: none"> - None (wall mounted) - Pedestal for one wallbox - Pedestal for two wallboxes back to back - Pedestal for two wallboxes at a 90 degrees angle



Public and commercial car charging – Use cases

Charging service should match application and demand

Public and commercial EV Charging

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DC-Wallbox

10-20kW/ Project with Car OEM's

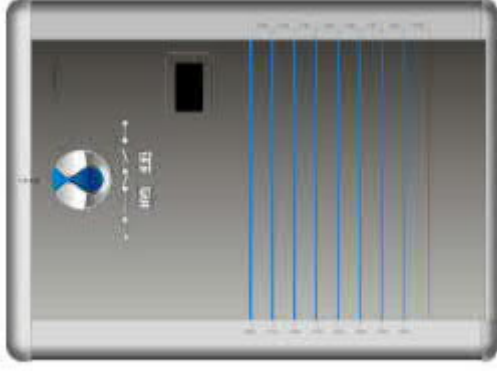


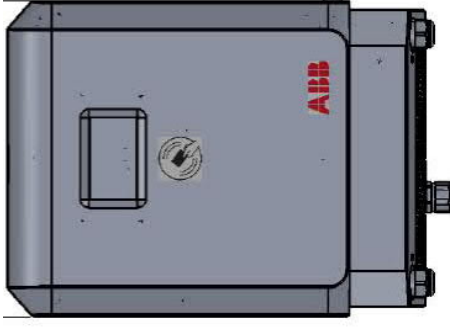
ABB has been and is working on a number of projects with Car manufacturers, like Porsche in Europe and Denza in China on DC-Wallboxes of 10 and 20 kW. These DC-Wallboxes were supplied with the car.
A generic DC-Wallbox was shown on the eCarTec in Munich in October 2013.

DC-Wallbox

Public use-case: single or dual outlet



Status:
in development



24 kWp / 22 kW continuous power (920 V version)

IP 54 outdoor housing

CCS cable, or multi-standard CHAdeMO + CCS

Connectivity, touch screen, RFID, etc.





The ABB DC wallbox is currently under development.
Expected availability is as follows:

- EU versions: production from March 2019 onwards
- US versions: production from April 2019 onwards

Public and commercial car charging – Use cases

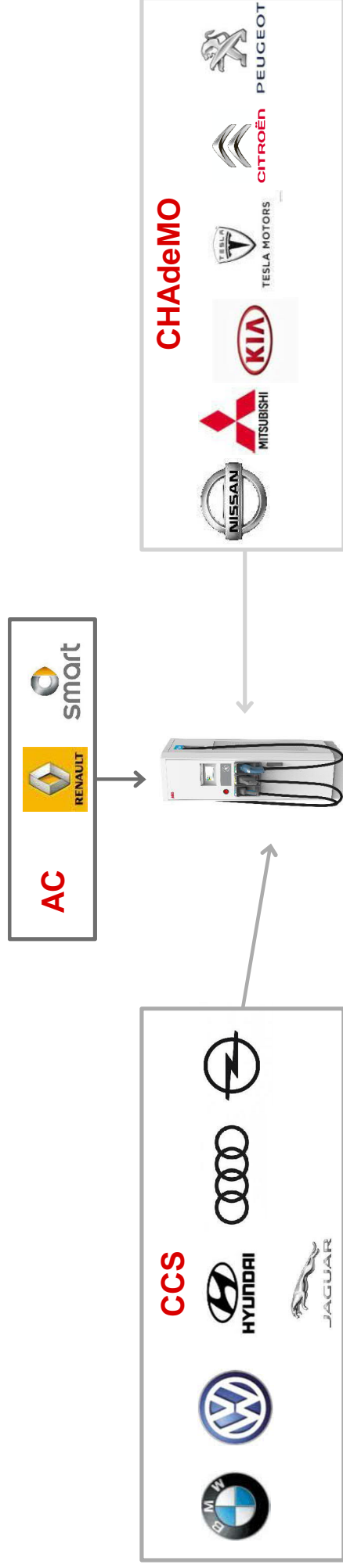
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Multi-standard charger solution Terra 54 & Terra 24

General explanation of naming convention



Terra 54 (50kW)

Terra 24 (20kW)

C - (Combo) = Combined Charging Systems (CCS)

J - (Japan) = CHAdemo

Z - (China) = GB

T - (Socket) = Type 2 Socket

G - (Grid) = Cable + Type 2 Connector

- DC

- DC

- DC

- AC

- AC







HV = High Voltage

CCS: 200-920 V

CHAdemo: 150-500 V

Highway and metropolitan segment

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

<p>Terra 54 CT DC+AC Charger</p> <p>50kW DC CCS-2 22kW AC</p>  <p>Available</p>	<p>Terra 54 CG DC+AC Charger</p> <p>50kW DC CCS-2 43kW AC (also 22kW version)</p>  <p>Available</p>	<p>Terra 54 CJ DC Charger</p> <p>50kW DC CCS-2 50kW DC CHAdeMO</p>  <p>Available</p>	<p>Terra 54 CJG DC + AC Charger</p> <p>50kW DC CCS-2 50kW DC CHAdeMO 43kW AC</p>  <p>Available</p>	<p>Terra 54 CJG DC + AC Charger</p> <p>50kW DC CCS-2 50kW DC CHAdeMO 22kW AC</p>  <p>Available</p>	<p>Terra 54 CJT DC+AC Charger</p> <p>50kW DC CCS-2 50kW DC CHAdeMO 22kW AC</p>  <p>Available</p>
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Public and commercial car charging – Use cases

Charging service should match application and demand

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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:		350 kWp
Charging cable & connector:	CCS 1&2:	Small diameter, active liquid cooling
	CHAdeMO:	conventional

ABB High power charging 2018-2025

Towards 15 minute charging – 400 km/ 250 Mi driving

Terra 54



50 kW

125 A

3½x more power

3x higher current

Terra HP – 1 cabinet



175 kW_p

375 A

7x more power

4x higher current

Terra HP – 2 cabinets



350 kW_p

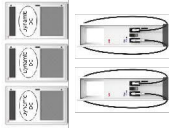
500 A



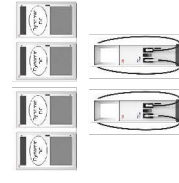
Dynamic DC:
patented by ABB

Power expansion

1 cabinet expansion



2 cabinet expansion



eBus Charging

3 main ways of charging buses

ABB supports all standardized solutions supported by main Bus OEMs

CCS 2 connector



Pantograph Up (PU)



Pantograph Down (PD) - OppCharge

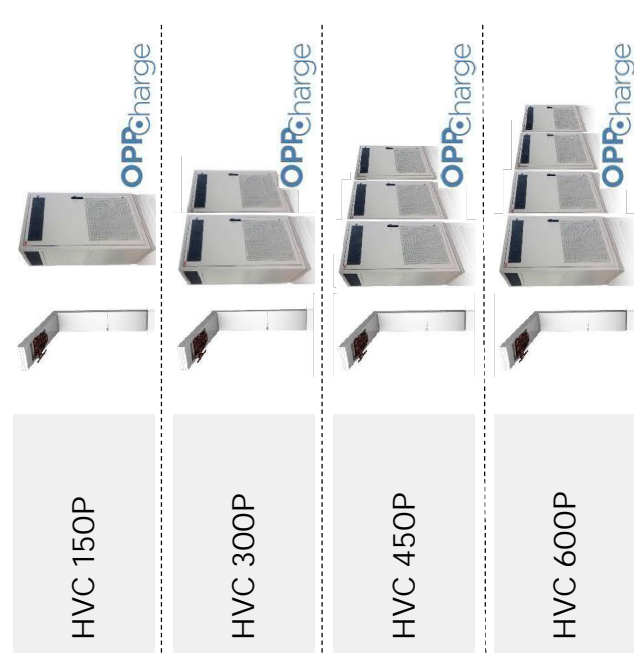


Product portfolio bus charging

CCS 2 connector



Pantograph Down (PD) - OppCharge



Pantograph Up (PU)



Overnight charging

With CCS-2 connector + cable

Industrial quality power cabinet

50 kW, 100 kW and 150 kW

100 kW field upgradable

Redundancy from 3 x 50 kW power module (Terra 54HV: 5 x 10 kW)

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



Terra 54HV C



HVC 100C

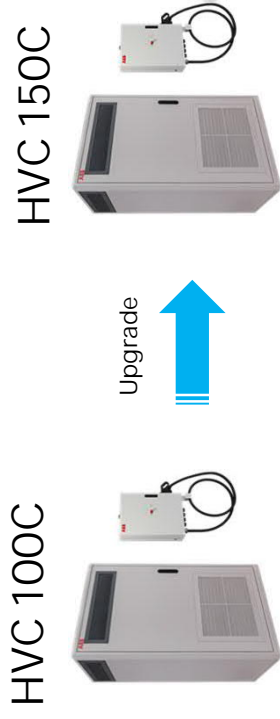


HVC 150C

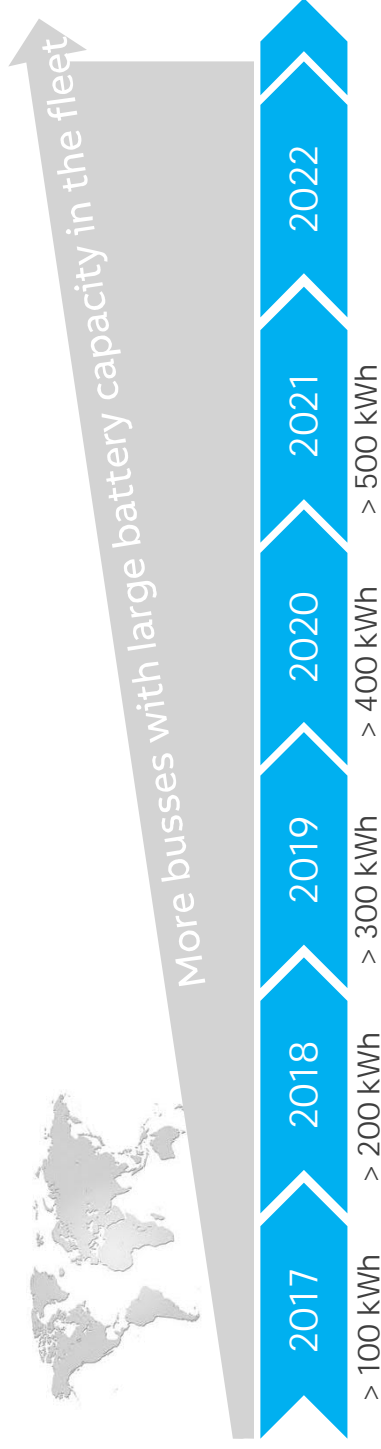


Overnight charging 50 kW- 150 kW

ABB's field upgradeable system is future proof



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



Smart charging

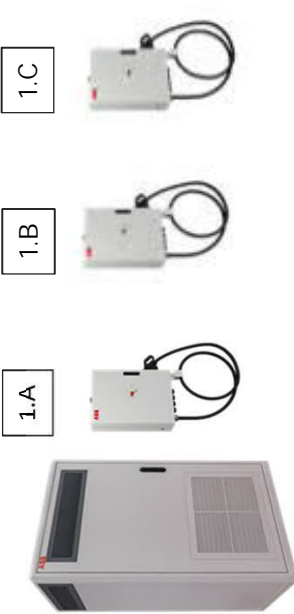
Sequential charging for improved TCO, simple operations management and peak shaving



- A single 150 kW charger charges up to 3 busses.
- Significant reduction on the required grid connection: the total charge load per 3 busses is reduced from 450kW to (simultaneous charge) to 150kW.
- In an overnight session (6 hours) three 300 kWh busses can be fully charged.
- Very cost effective solution with the introduction of three low cost, low maintenance charge boxes.
- Ability to remotely `wake up` busses for top up charging (100 % SOC) and heating & airco.
- Power converters at distance at convenient location
- Compact charge box with cable close to bus parking area

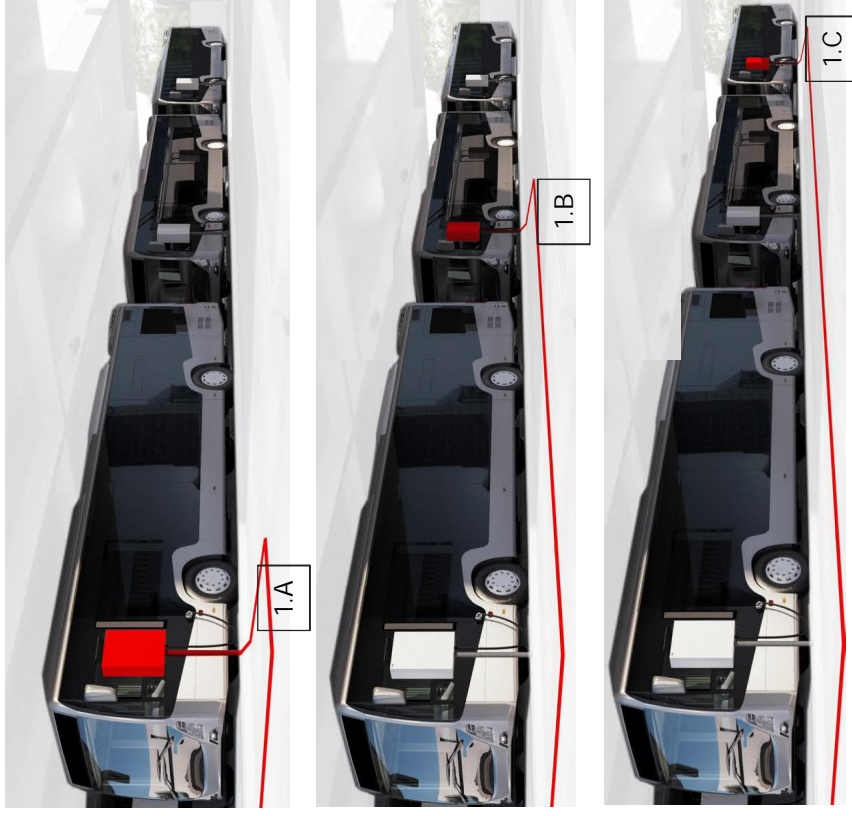
Sequential charging

How does it work?



1.A 1.B 1.C

- 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.

—

Connection to back-office & payment systems

Manage, monitor and connect to your business

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



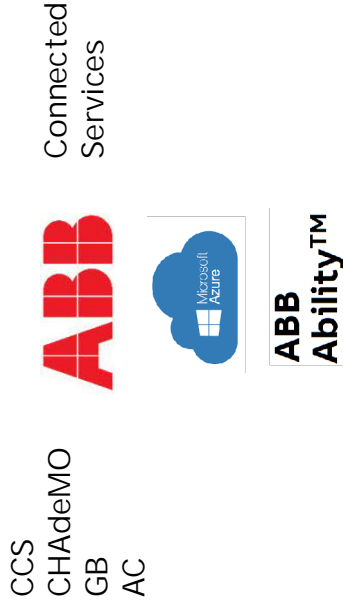
Reliable 24/7 connectivity is fundamental for a commercial operation of a network of chargers!

Positioning connected services

Electric cars



Charging infrastructure



Solutions to run a charger network

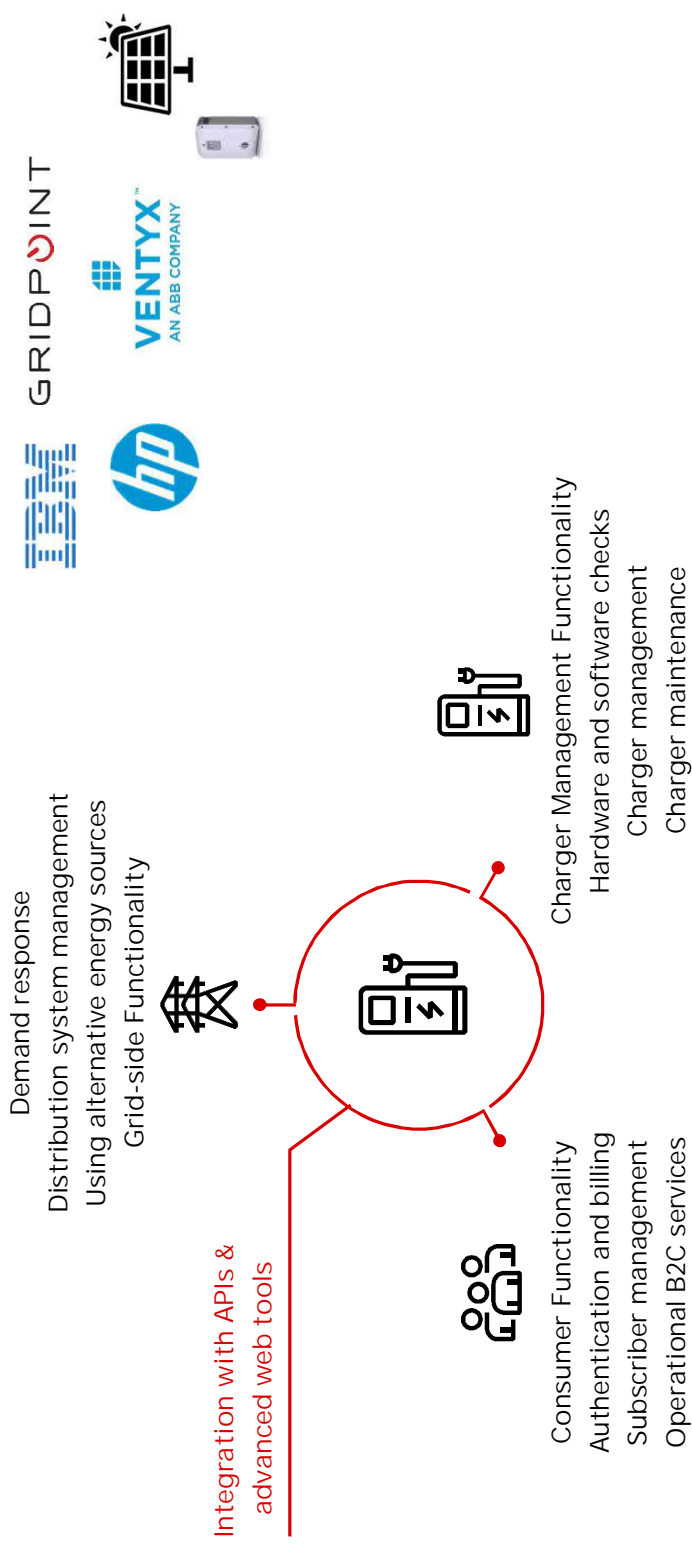


ABB does **not** have exclusive cooperation with any of the solutions



Platform based integration of an ABB EV charger

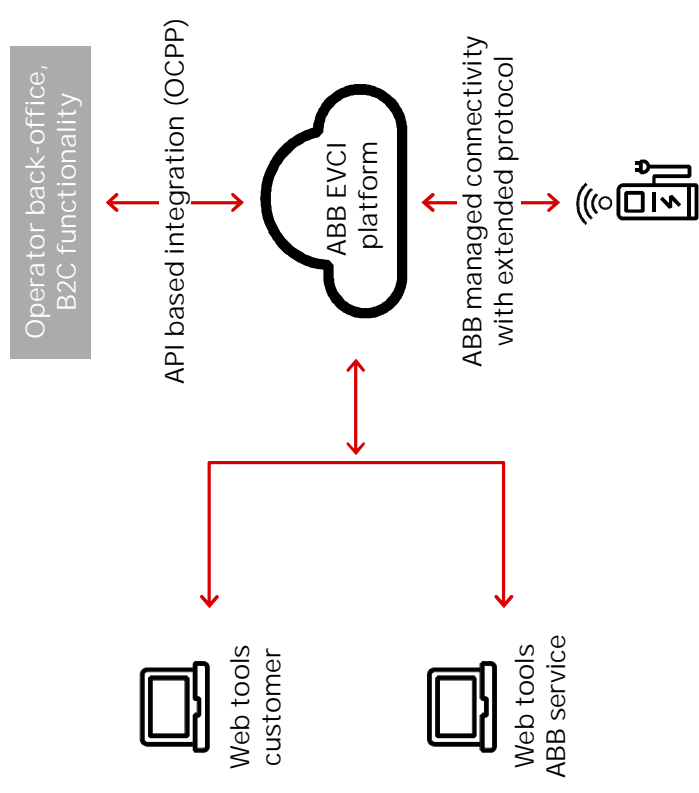
Enabling you to face the dynamic challenges of the industry



Digital integration of an ABB EV charger

ABB's solution

- Highly redundant cloud platform
- Extended protocol to the charger
- Over 7.000 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



Digital integration of an ABB EV charger

Dual Uplink Option – Combining direct OCPP with the benefits of the ABB EVCI platform

Benefits

Combine benefits of EVCI platform with direct OCPP setup

In case of a multi-brand network with AC and DC chargers, apply one OCPP connectivity model for all chargers in the network

Details

Available in end of July 2018 on HPC, at end of 2018 in Terra 53/54

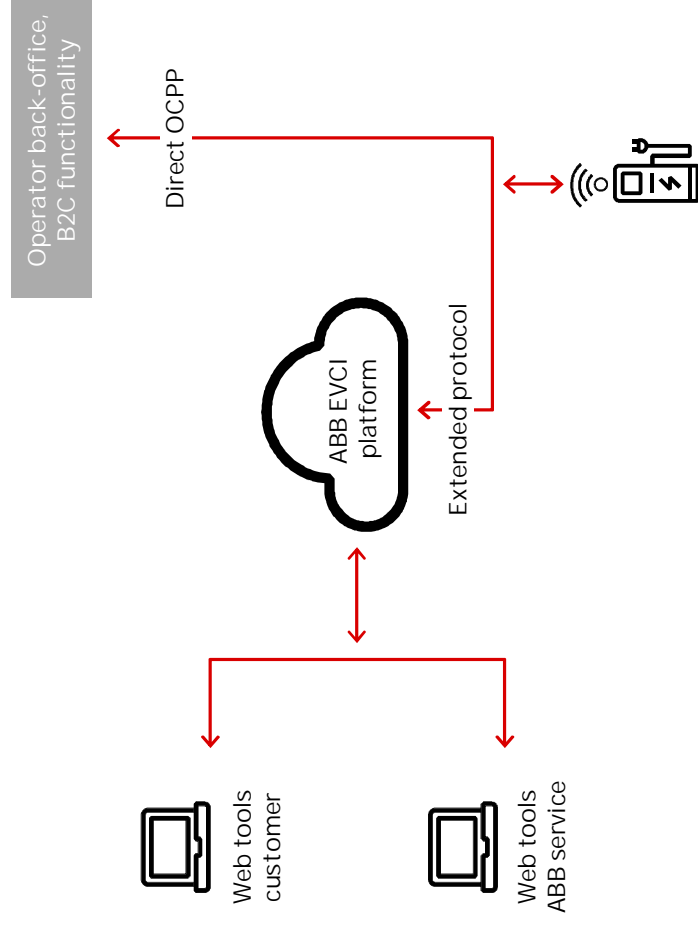
Only for OCPP 1.6 (using JSON via websockets)

Both communication channels use the same internet connection (either SIM or Ethernet) to send data to the two different end points

The IT setup for dual-uplink is more complicated for the operator than in a “platform-to-platform” setup using the internet based OCPP API:

- Customer needs to ensure scalability of the IT platform (number of connected chargers)
- Customer must manage/ monitor the websocket and the M2M communication to ensure OCPP communication
- Customer must implement redundancy & failover mechanisms for live maintenance on own platform and gateway

Same commercial model as in cloud to cloud setup (Charger Connect plus OCPP API)



EVI Global Service

Charger care and internet of things, service and people

ABB is able to diagnose more than 90% of the service cases remotely, solving over 60% of these cases without any on-site intervention.

This results in significant savings on down-time, travelling, transportation, man-hours and resources.

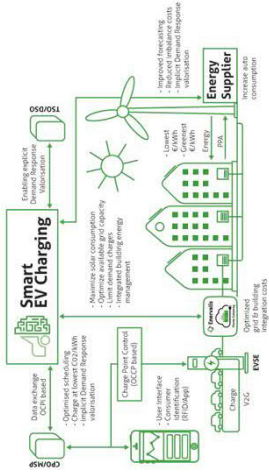
Charger care increase the safety, profitability and availability of our customers charging network.

The result is best customer experience at low total cost of ownership!

E-Mobility grid Integration

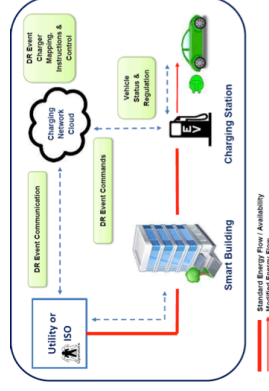
Business Models for up to 100% EV utilization

EV Charging as service



- Integration with Apps
- Communication ecosystem
- Charge customers
 - on time of usage
 - on time of charge
- Chargepoint & infra operation

Charging as utility



- Storage technology
- Typically in buildings and offices
- Owned by utility, operated by building mgmt. or 3rd party
- Billing as per usage

EV Highways



- Multi-source integration
- Integrated power & connectivity
- Urban & rural systems
- Off-grid, weak-grid & on-grid systems for all conditions

New ecosystem developing in all segments

Charging Station/Infrastructure

From Government of India – Ministry of Power



From Ministry of Power – 18th Dec 2018

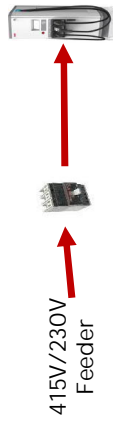
Public Charging Station

Type	Charger Connectors*	Rated Voltage (V)
Fast	CCS (min 50kW)	200 – 1000
	CHAdeMO (min 50kW)	200 - 1000
	Type-2 AC (min 22kW)	380 - 480
Slow	Bharat DC-001	72 – 200
	Bharat AC-001	230

- Multi-standard charger (CCS, CHAdeMO & AC Charging) with slow Bharat chargers
- Database will be maintained by CAE & DISCOMS.
- Tariff will not be more than 15% of the supply cost (future). Current is benchmarked in Delhi @ Rs. 4.85/u.
- Phase 1 → Highways & Phase 2 → Infrastructure
- Letter from Secretary on 14th December 2018 (Express roll-out)

Private Charging

- Specific to the manufacturers and owners
- Independent circuit
- AC charging for villas and small households
- Automation is promoted for efficiency



- One per grid (3km x 3km)
- One long haul charger per 100kms
- Existing petrol pumps as priority
- State-level for implementation

ABB