



CHAdeMO DC charging standard: evolution strategy and new challenges

Stuttgart, 16 April 2019

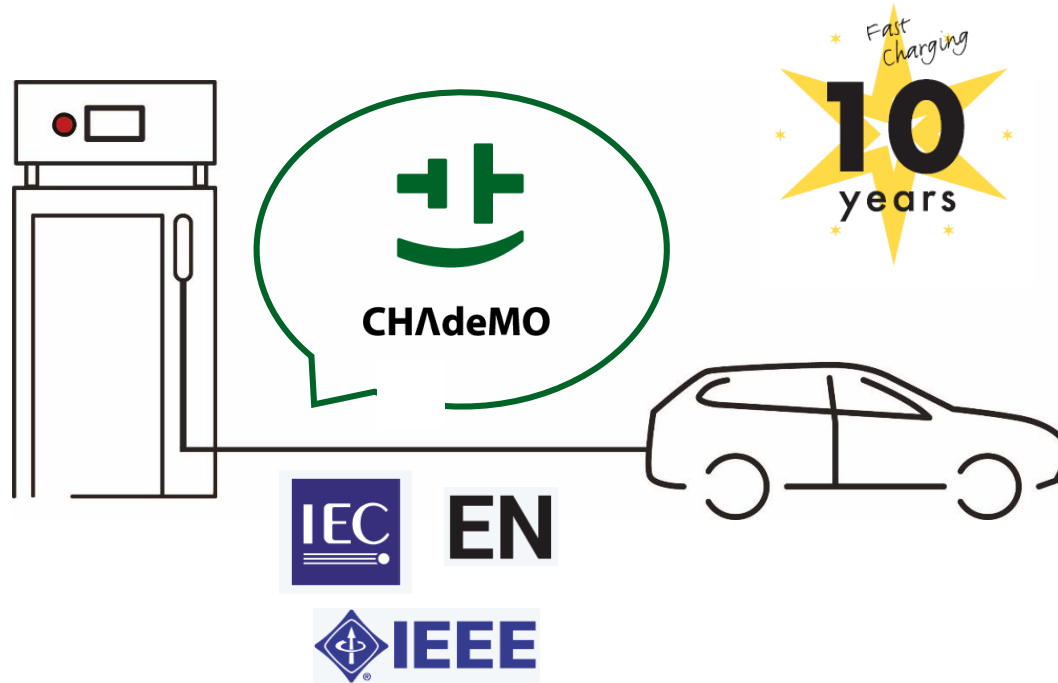
Tomoko BLECH

Agenda

- CHAdeMO basics
- CHAdeMO principles for evolution
- New challenges
 - HPC
 - Plug-and-Charge
 - V2X
- Summary



CHAdeMO and CHAdeMO Association



What do we do?



Association members



Our
members:

420
entities

from
41
countries

And many, many more..

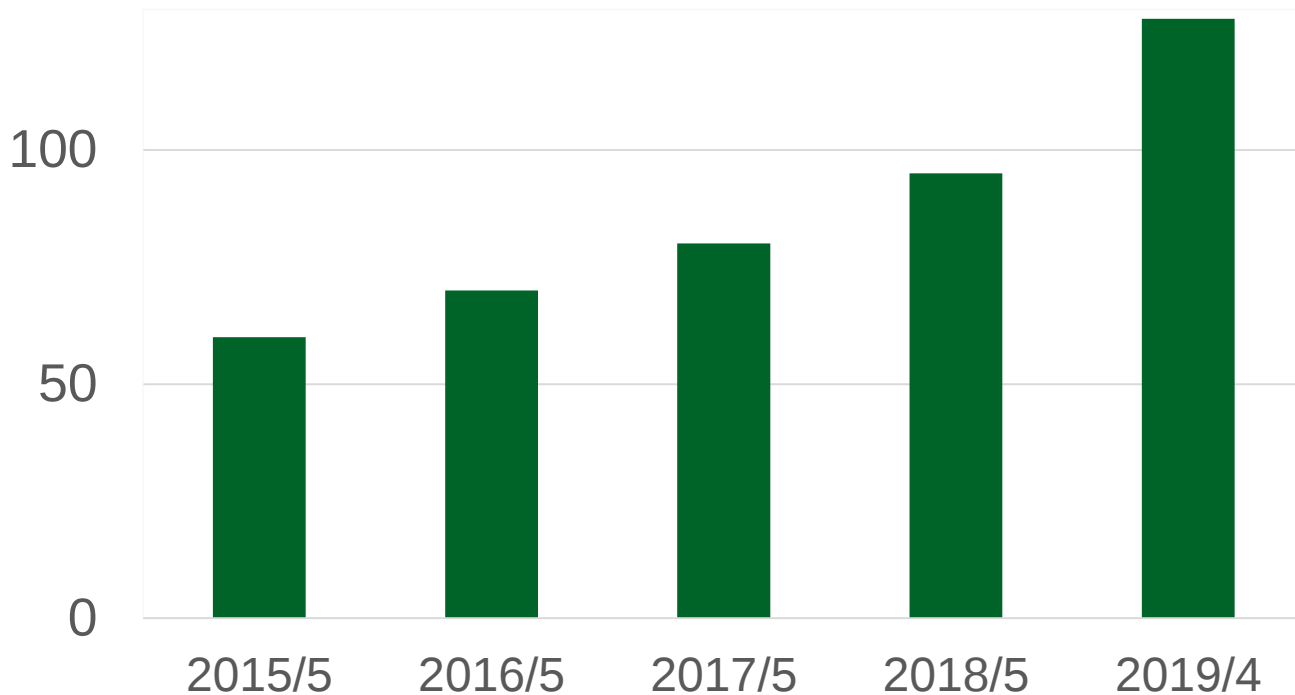
CHAdEMO members in Europe

130

EU members

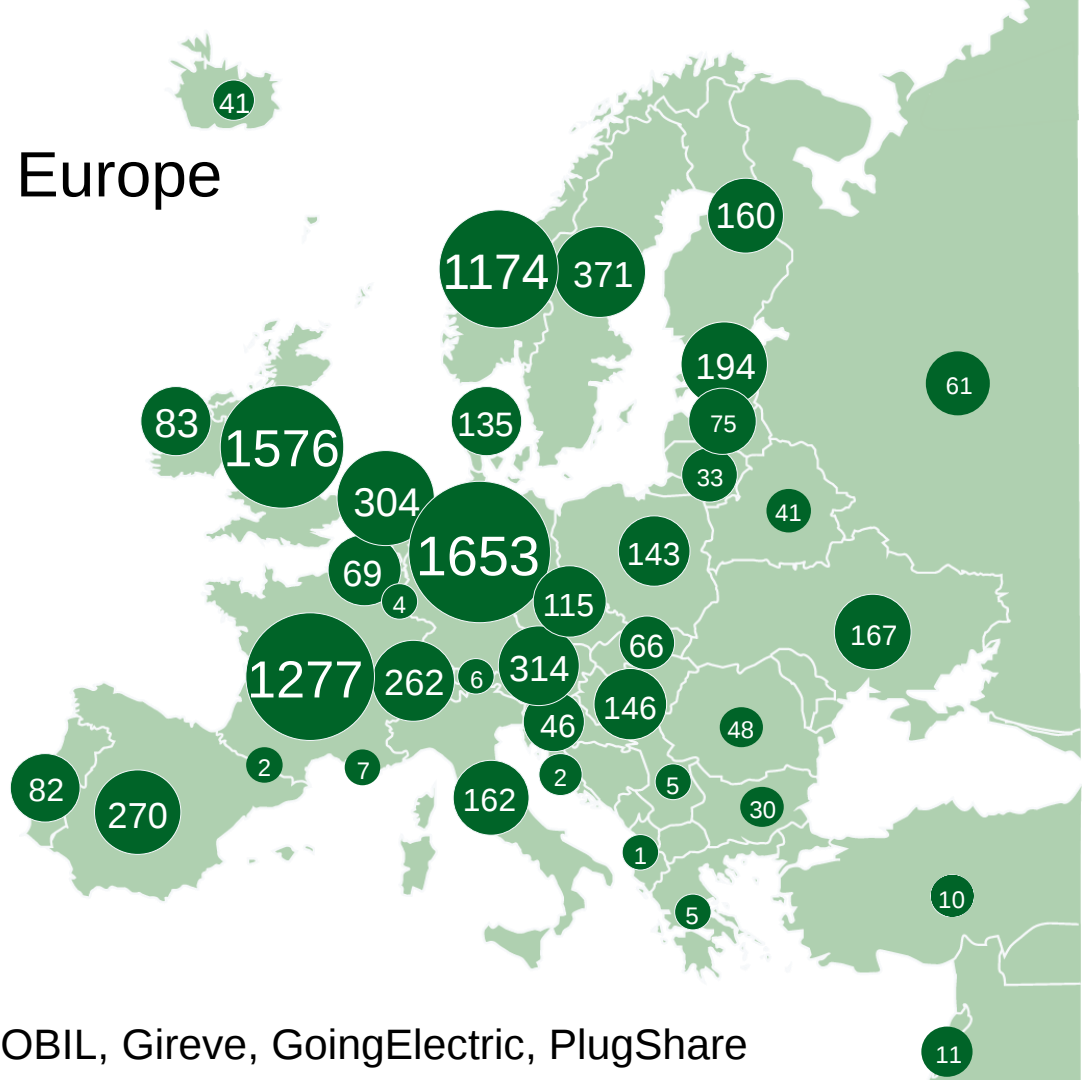
26

Countries



CHAdEMO charger points in Europe

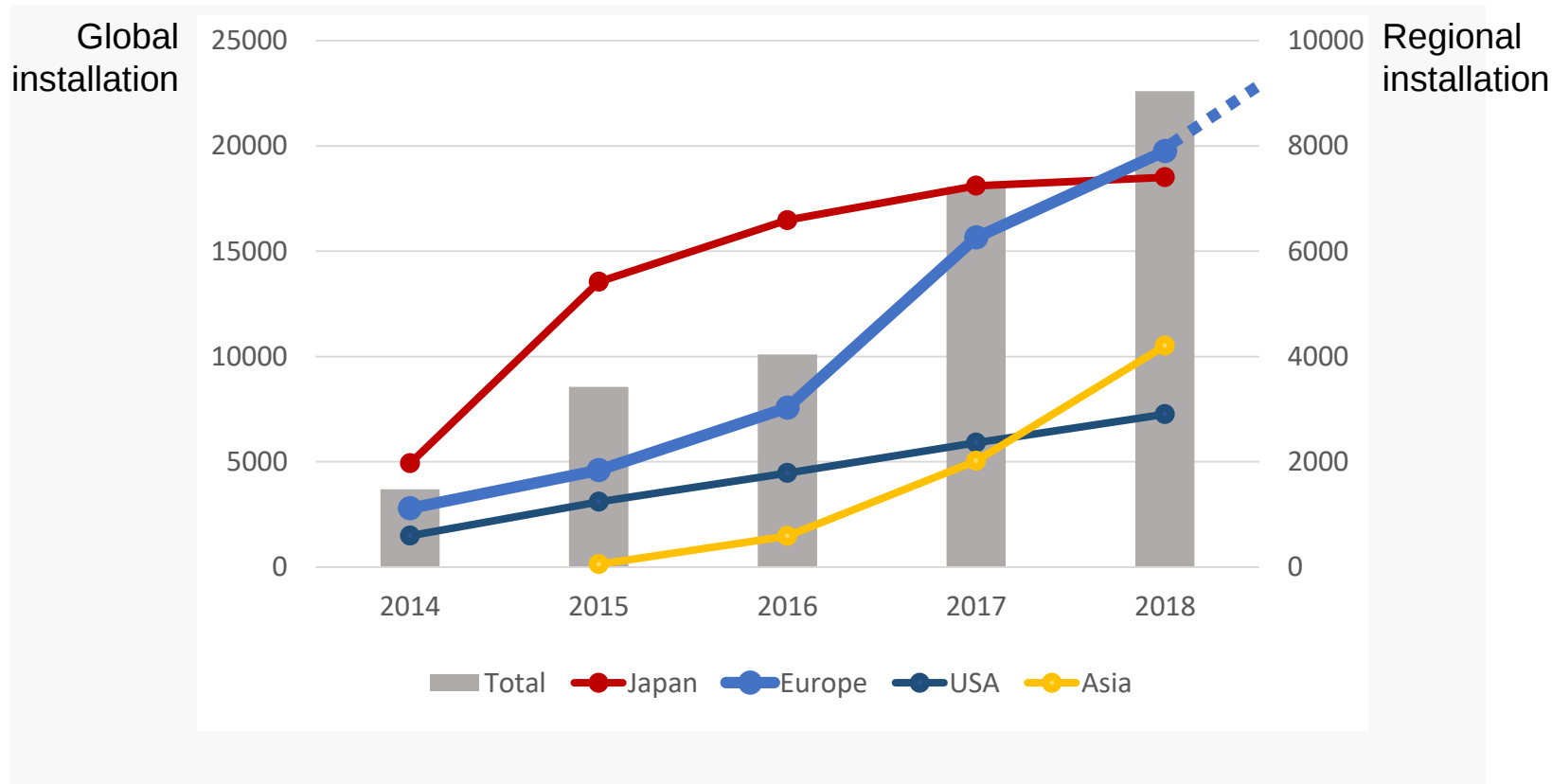
9 180
TOTAL



Note: as of April 2019 (preliminary)

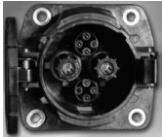
Source: ChargeMap, EAFO, Zap-Map, NOBIL, Gireve, GoingElectric, PlugShare

CHAdemo installation by region



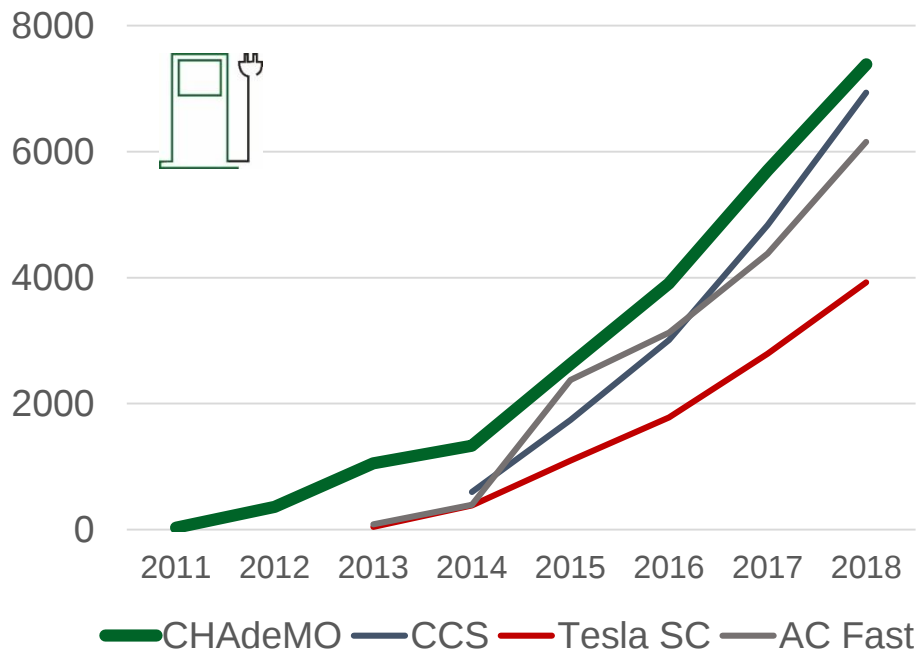
Source: CHAdemo Association, as of September 2018

CHAdeMO: international/regional standards

		CHAdeMO (Japan)	CCS Combo1 (US)	CCS Combo2 (DE)	GB/T (PRC)	TESLA
Connector						
Vehicle Inlet						
		✓	✓	✓	✓	
		✓	✓ (SAE)			
		✓		✓		
		✓	✓	✓	✓	
		✓ (Reference)			✓	

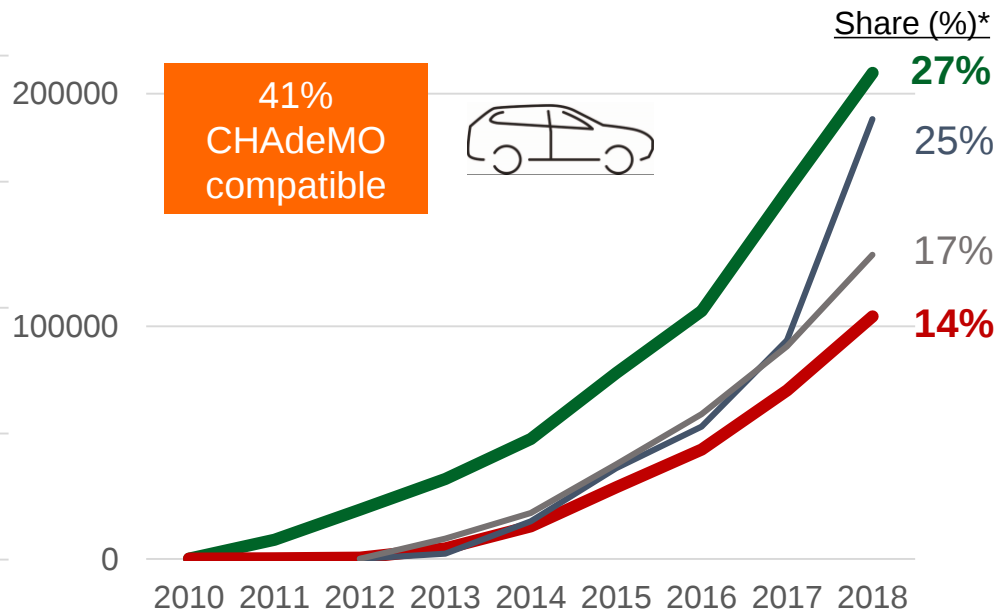
CHAdEMO charge points and plug-ins in Europe

Evolution of EU fast charge points
(cumulative)



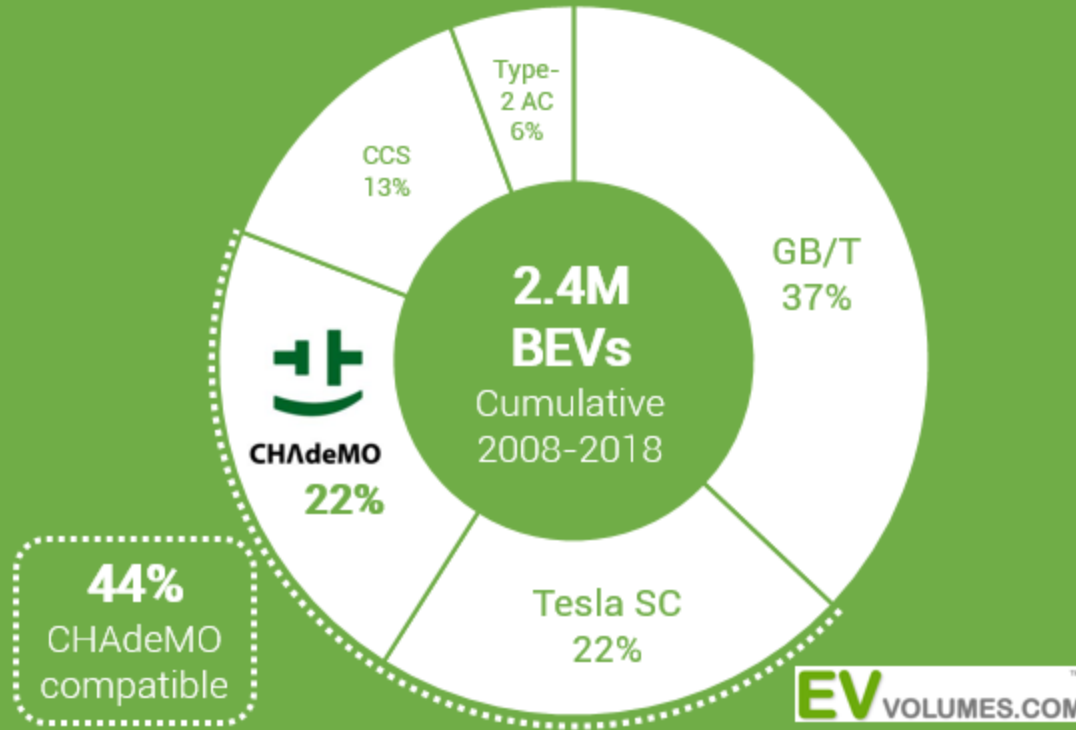
Source: EAFO, AC fast > 22kW

Cumulative European BEV sales by fast
charging inlet type (2010-2017)



Source: EAFO, JATO, EV-volumes.ocm; BEVs only
*Total does not include non fast-chargeable BEVs (17%)

GLOBAL FAST-CHARGEABLE BEV INLET SHARE



Source: EV-volumes.com; BEVs only, excluding non fast-chargeable BEVs (33%)

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CHAdEMO principles for evolution

- **A**daptation (**a**s flexible as possible)
- **B**ackward compatibility
- **C**ore values

Adaptation (**a**s flexible as possible)

DC charge at home/office
(6-10kW)

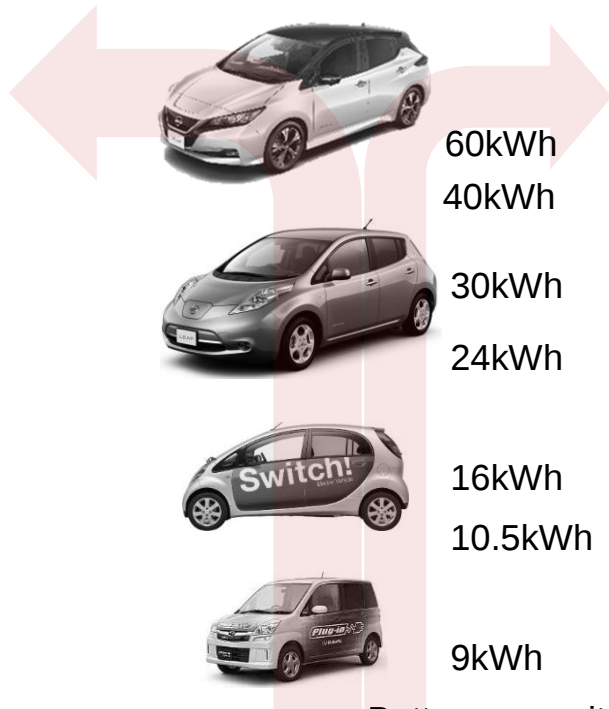


Enhanced V2X
Functionality



Battery as energy device

- Peak cut
- PV connection
- VPP participation
- Resilience
- Leisure



Battery capacity

High Power Charging
(50kW+)



Varied charge
options

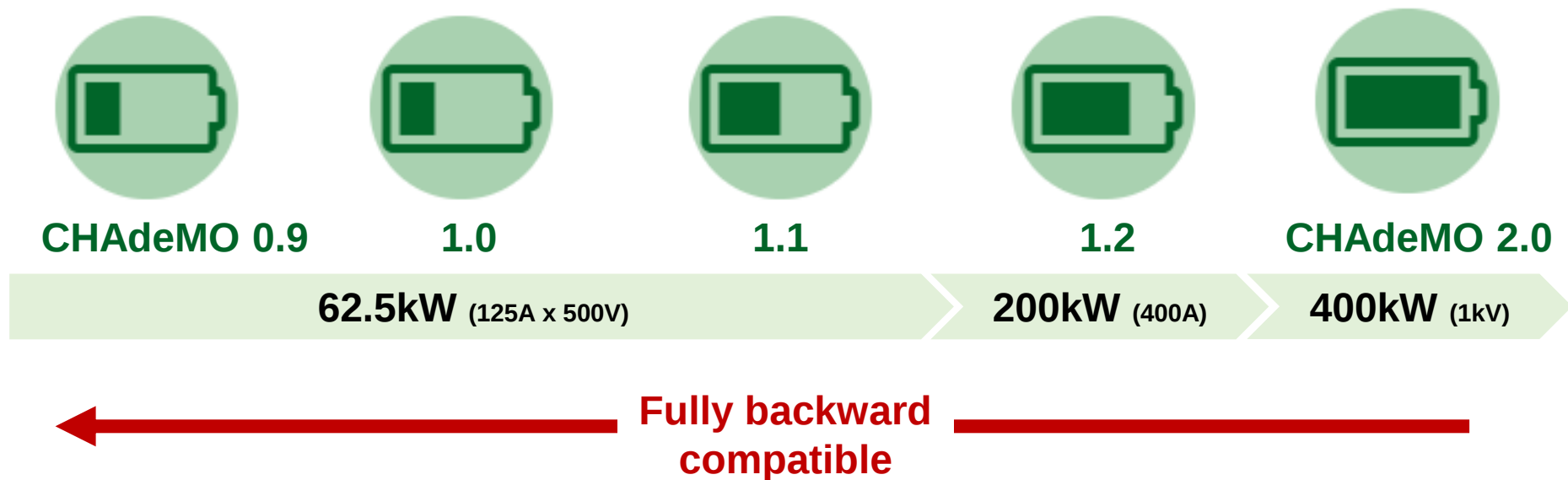


More varied charging

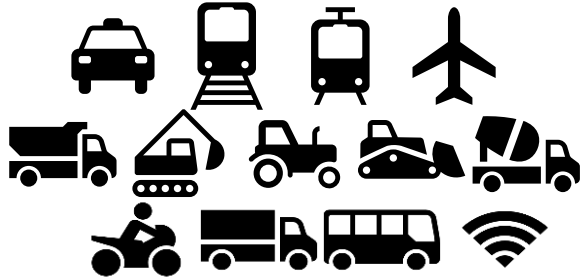
(22kW, 50kW, inductive, smart charge..)

- Full charge
- Top-up
- During stay
- Low Power (low cost)
- Charge guided by AI

Backward compatibility



Core values: safety, CAN, interoperability



New techno
High power/voltage, V2X,
PnC, Smart Charging..



Compliant variants

CHAdeMO Core
Safety / Communication
protocol / Certification...

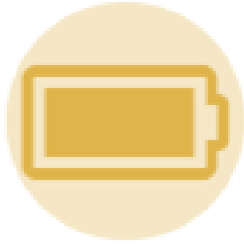
Regional variants



CHAdeMO
(THE ORIGINAL)



Next-gen ultra-fast protocol: harmonisation with GB/T



New protocol

Target 900kW
(600A x 1.5kV)

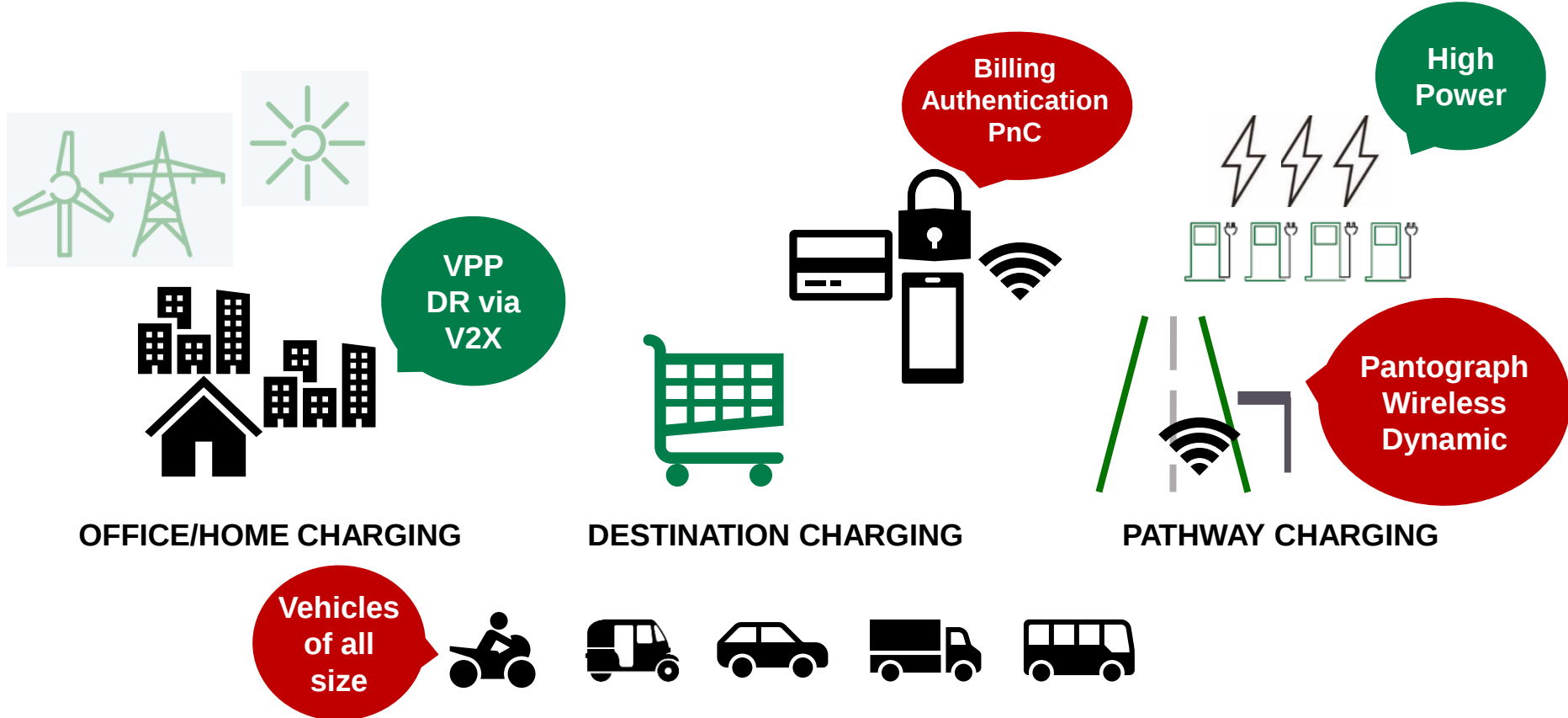
- Co-development with CEC (China Electricity Council)
- For vehicles including **trucks**, **buses** and **passenger vehicles**, and even **electric aircrafts**, which require reduction of the charging time

ChaoJi



- New connector shape
- **Full backward compatibility** with current CHAdeMO and current GB/T (and CCS)
- Aimed for 2020
- V2X and PnC included in scope

All possible with CHAdeMO



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HPC development timeline



CHAdemo1.2/2.0

2018

2019

2020

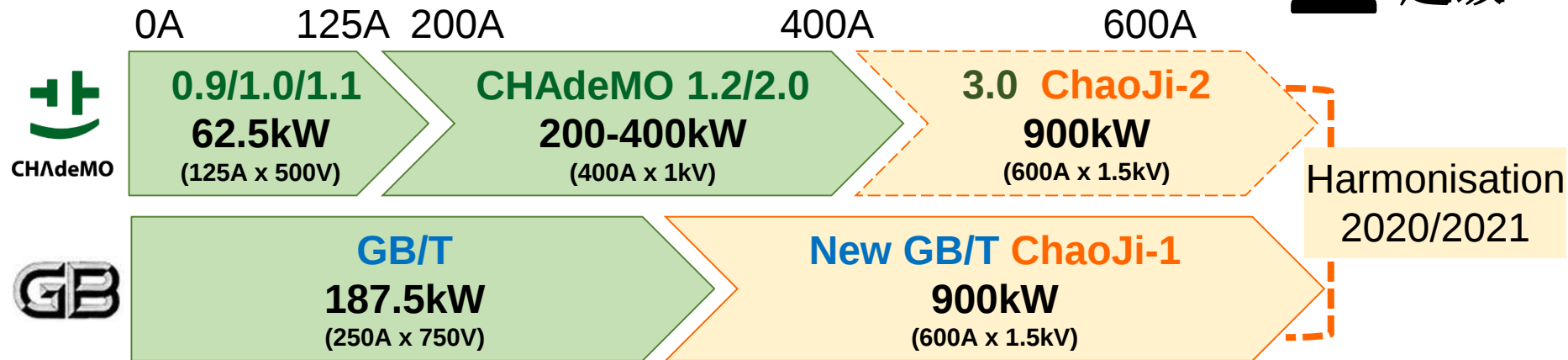
HPC

Prototype tests
(JP/EU)

Production
connection tests



HPC: specs and roadmap



ChaoJi key points:

- ✓ **Control-pilot circuit** harmonised with new GB/T and CCS (and IEC 61851-23-1)
- ✓ **Backward compatibility** with CHAdeMO, GB/T and (potentially) CCS
- ✓ **Simple, light and compact** connector
- ✓ **Future proof** covering currents up to 600A with liquid-cooling
- ✓ **V2G and PnC** ready
- ✓ **Optional combo-style inlet** integrating AC type-1, -2 and GB/T-AC

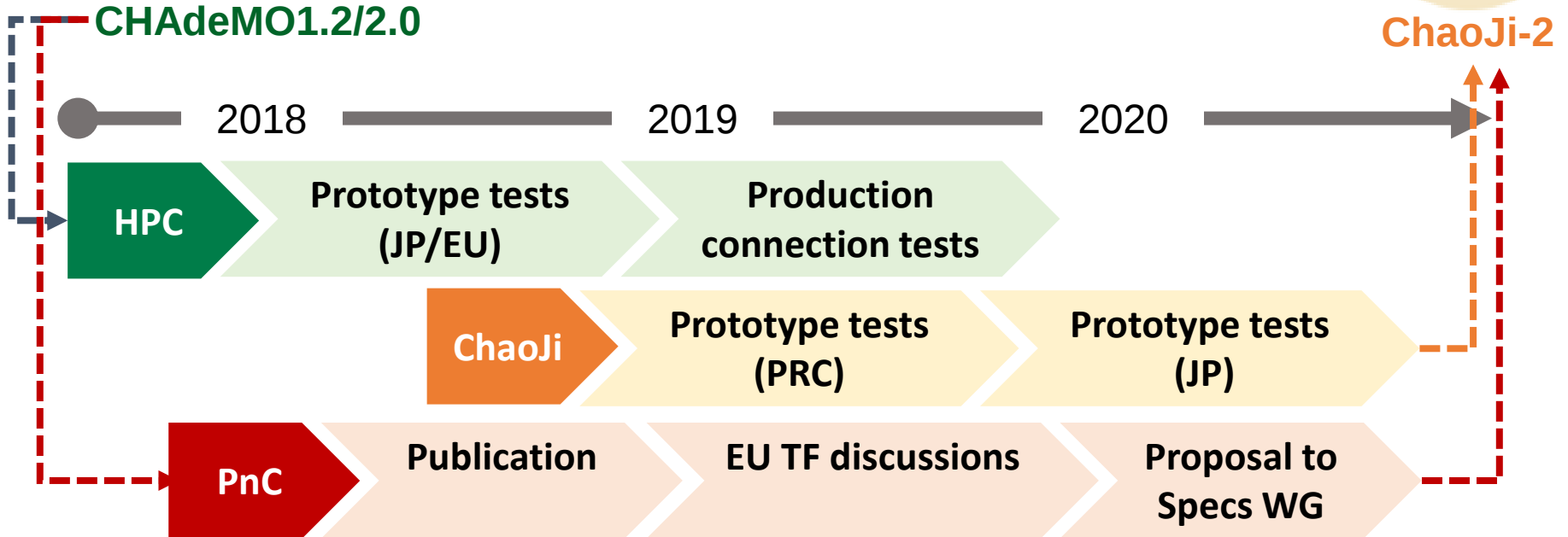
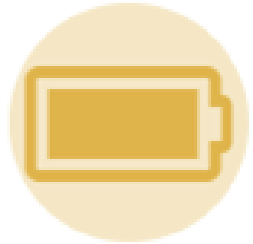
HPC: challenges and potential solutions

		Vehicle			
		CHAdEMO R4~2.x	GB/T-2011 or 2015	CHAdEMO 3.0 (ChaoJi-2)	New GB/T (ChaoJi-1)
Charger	CHAdEMO R4~2.x	OK		Use adapter	Use adapter
	GB/T-2011 or 2015		OK	Use adapter	Use adapter
	CHAdEMO 3.0 (ChaoJi-2)	Use CHAdEMO- ChaoJi dual charger		OK	OK
	New GB/T (ChaoJi-1)		Use GB/T-ChaoJi dual charger	OK	OK

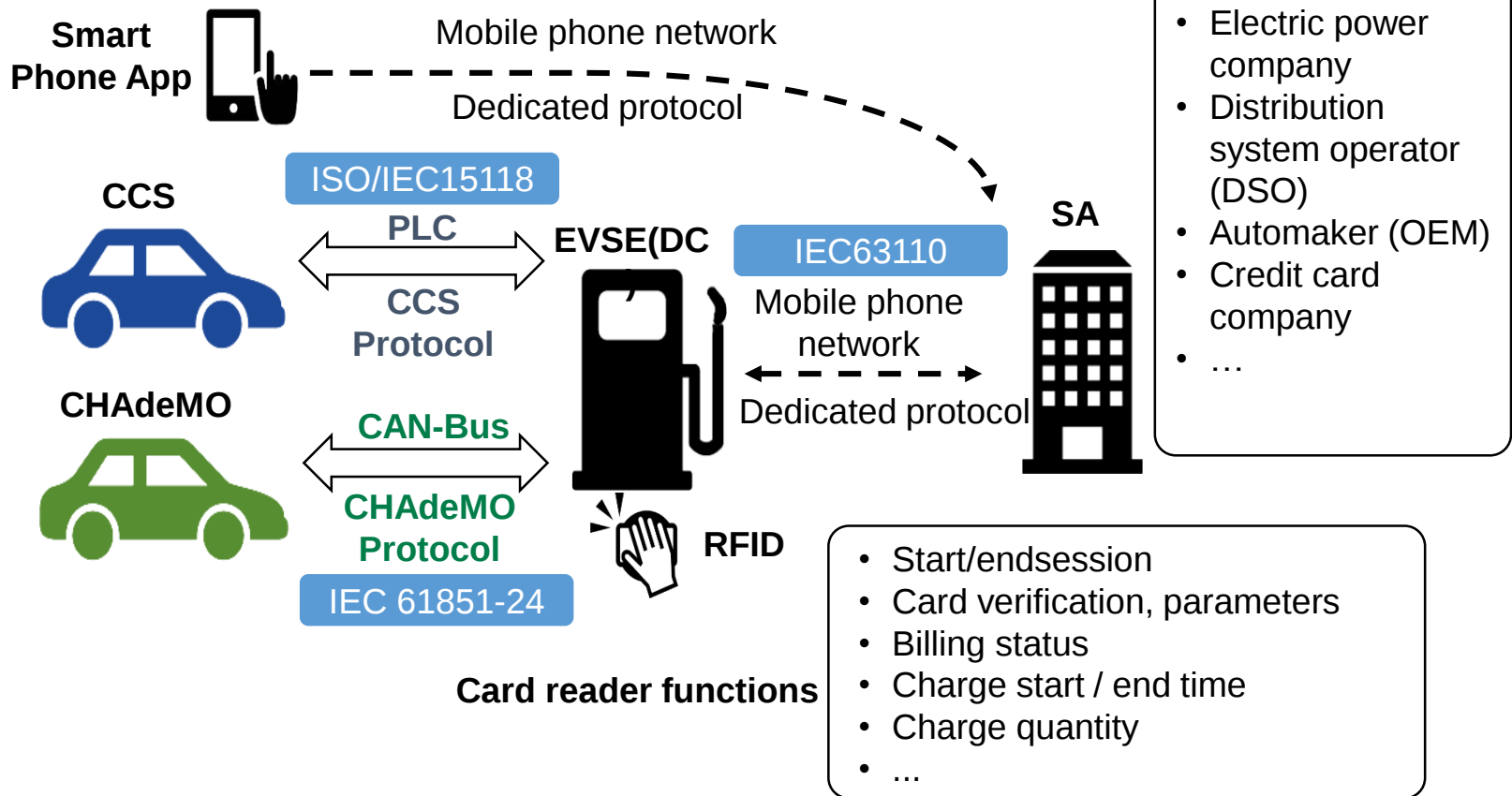
- New ChaoJi EVs will be able to charge with the existing CHAdEMO and GB/T chargers using an 'inlet adapter'.
- Existing CHAdEMO and GB/T EVs are not allowed to use any adapters, so they will need to use the dual chargers during the transition period.
- **Backward compatibility with CCS is also technically possible, detailed specification is under consideration.**

Note: the amendment of IEC 61851-1 is necessary for the use of adapter

HPC/PnC development timeline

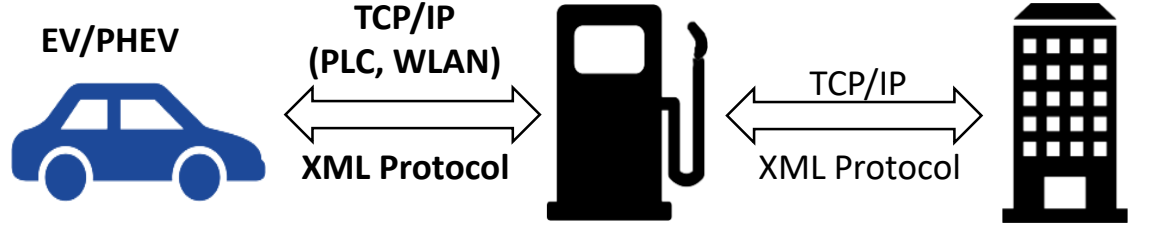


No PnC: DC fast charging

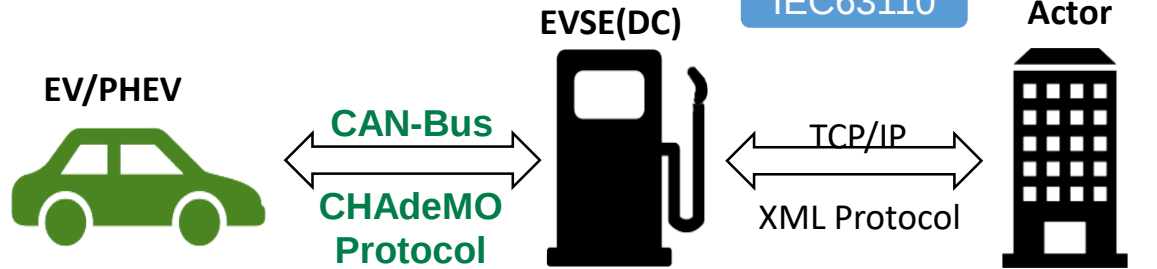


PnC: how it works

CCS PnC
(15118 Ed1)



CHAdeMO PnC
(CHAdeMO2.0)

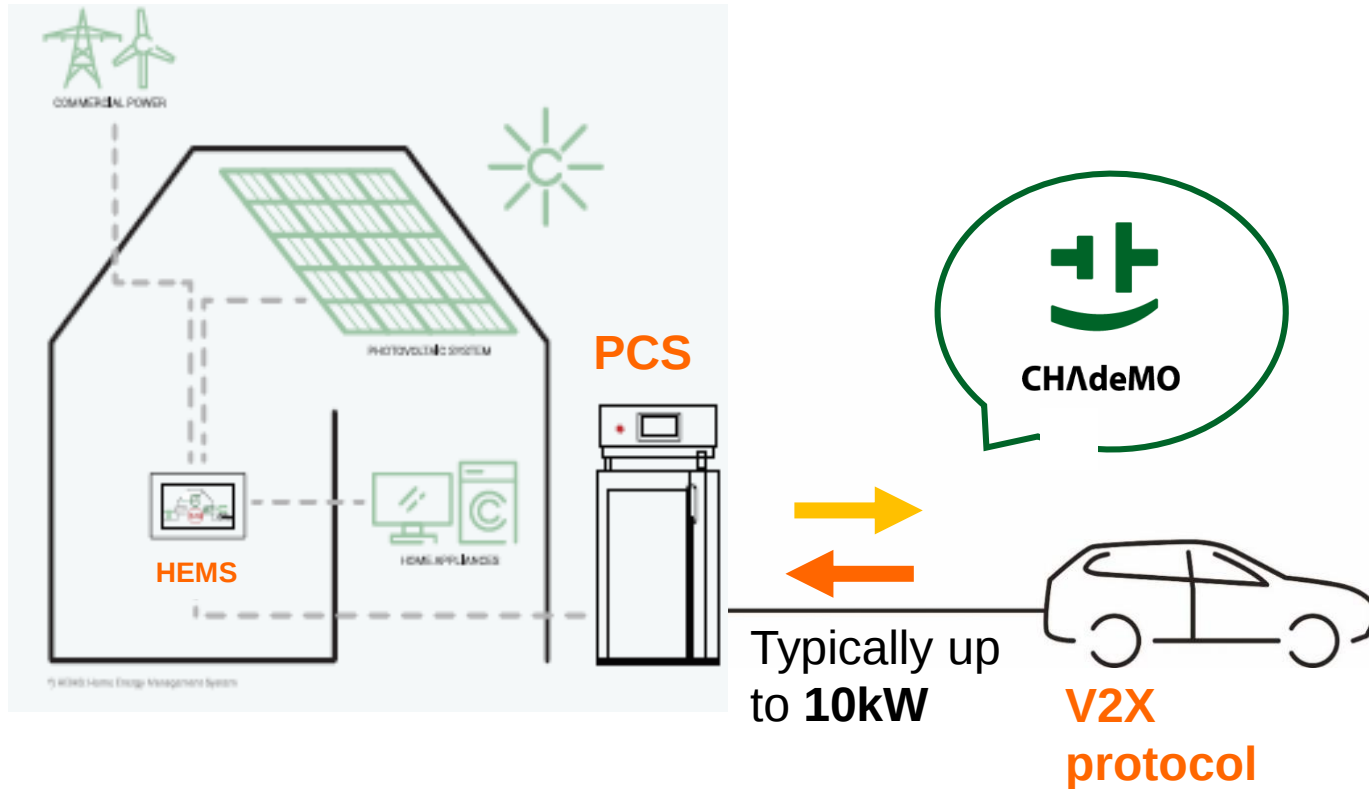


IEC 61851-24

EV-EVSE Functions

- Start/End session
- Card verification
- Billing status / details
- Charge status
- Certificate update
- Cable check
- Current demand
- ...

V2X: how it works



V2X products in the market

V2V (Vehicle)



V2L (Load)



V2H (Home-off Grid)

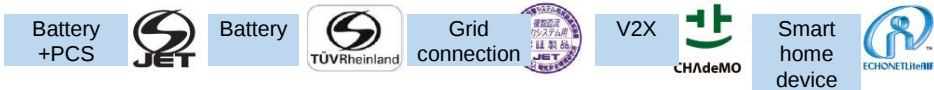
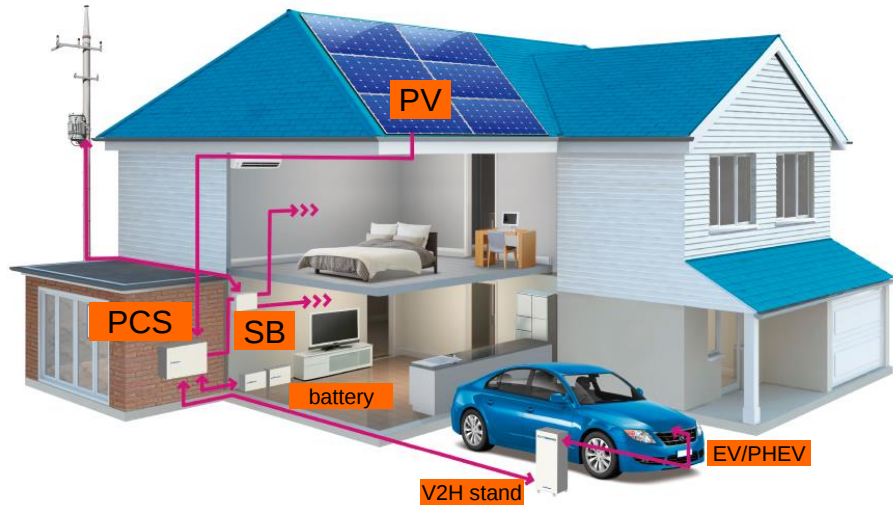


V2G/B/H (Grid)



V2X Market trend: multi-source systems

Multi-source system for homes



Source: Nichicon

Large-scale multi-source system



Source: TU Delft and Last Mile Solutions, PRE Power Developers

V2X Challenges

Technology

- Technically “proven”
- Further reduction of hardware price / weight needed, while maintaining DC output power quality

Regulations/ Market access

- Lack of standardised V2G grid access rules
- Technical standardisation and co-ordination

Users

- Low user awareness
- Further business model evaluation
- Adjacent issues e.g. insurance for battery degradation, etc.

Summary

- **CHAdemo's ABC**

- **A**daptability, **B**ackward compatibility, **C**ore values
(CAN / safety / interoperability, low impact to the grid)

- **Prescribe the minimum**

- Leave the rest to the market, especially communication

- **Collaborate**

- ... including harmonisation
 - And evolve with the market



THANK YOU!
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