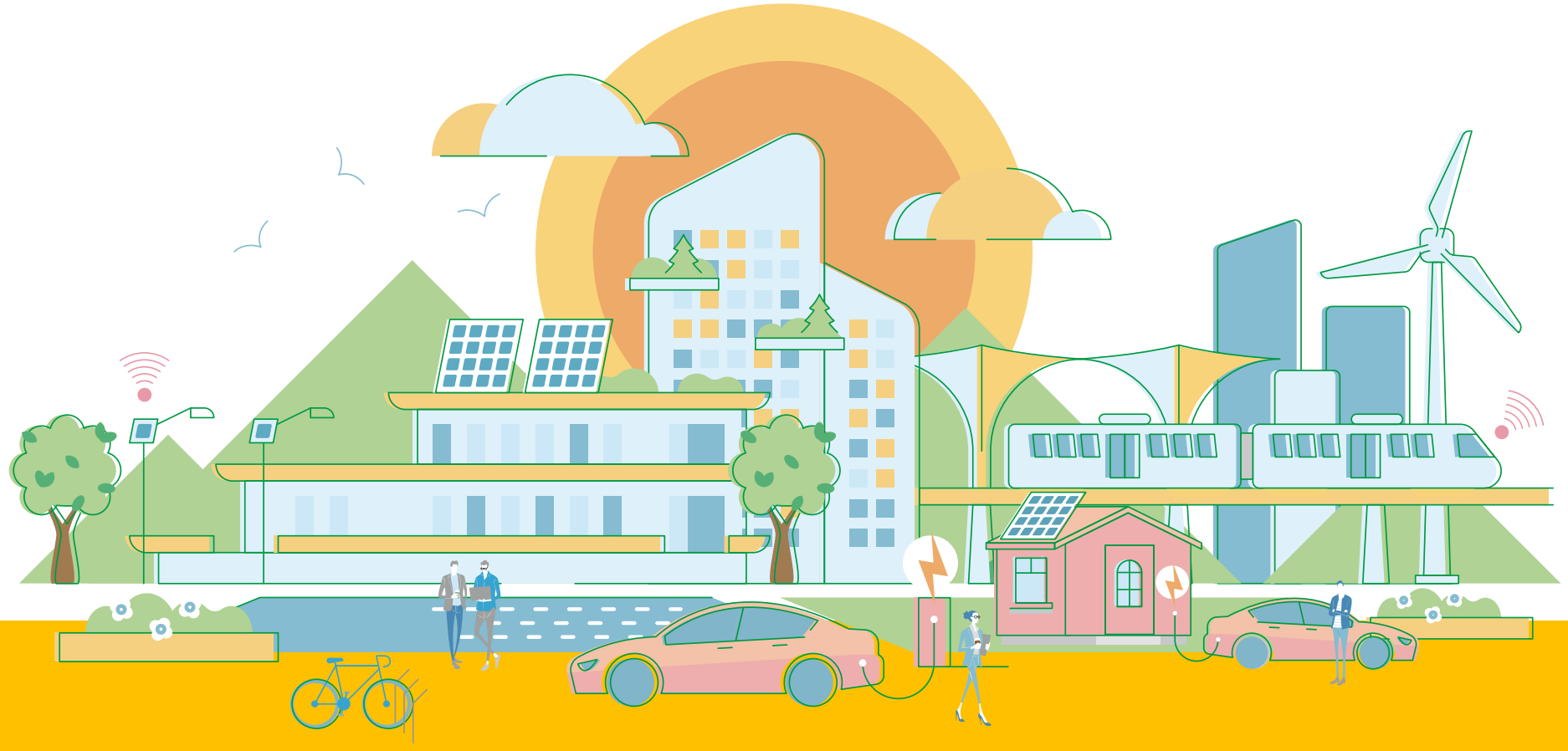
Successful transition towards nation- and region-wide zero-emission transport systems

13 April 2021

Makoto Dave Yoshida & Tomoko Blech

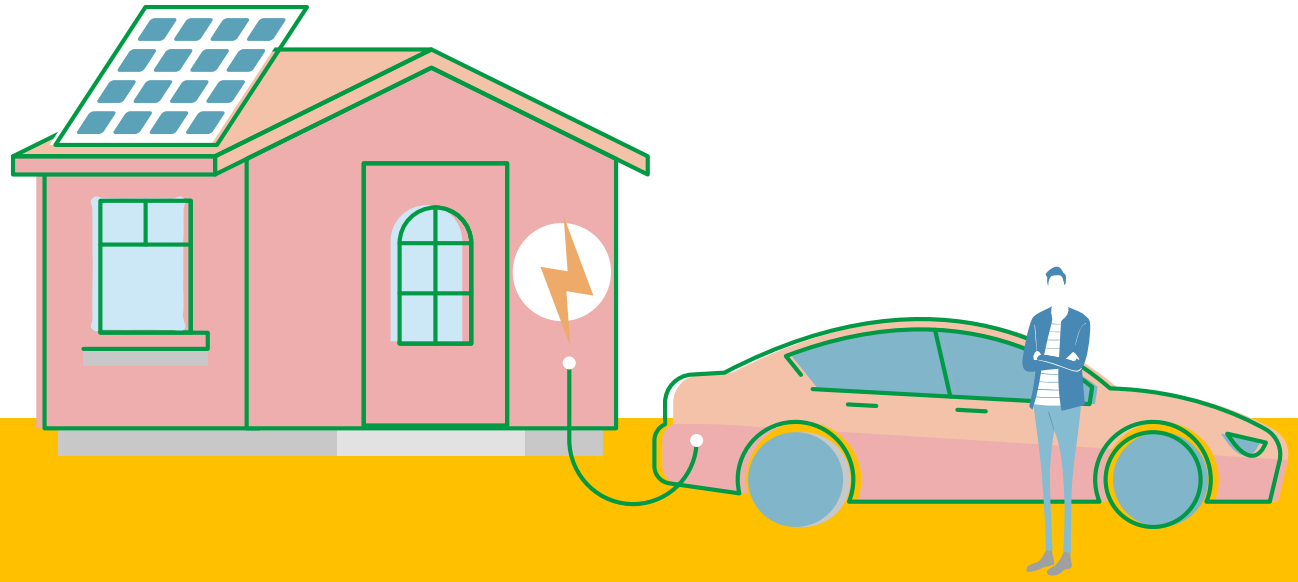
CHAdeMO Association



The seminar objectives:

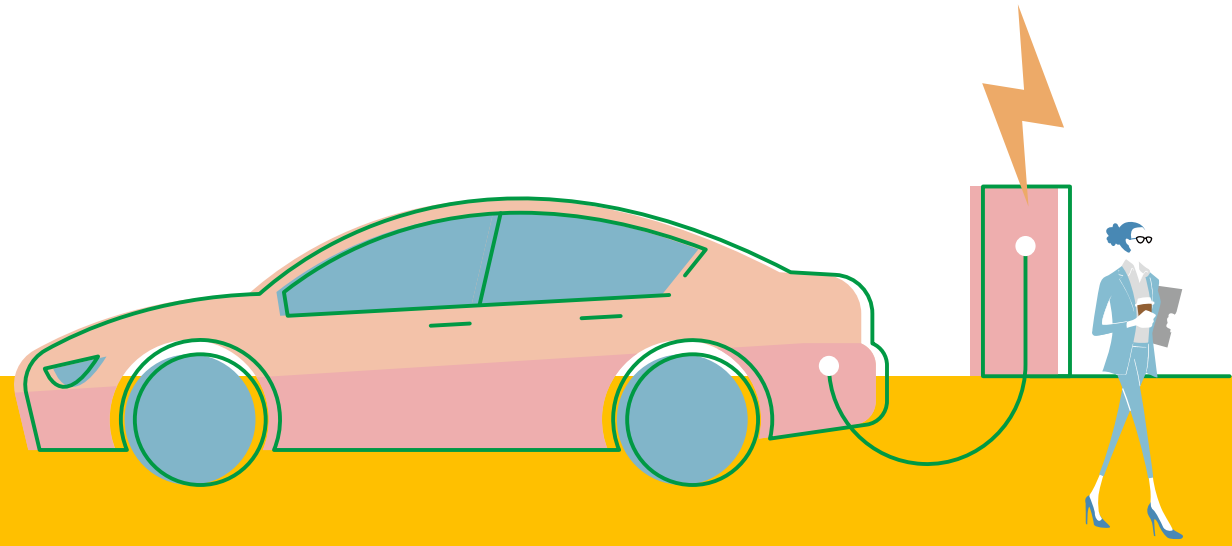
You will:

- Understand CHAdeMO and its DC charging technology
- Learn what the necessary elements of good charging infrastructure are
- Become equipped with practical knowledge on how to best develop charging network



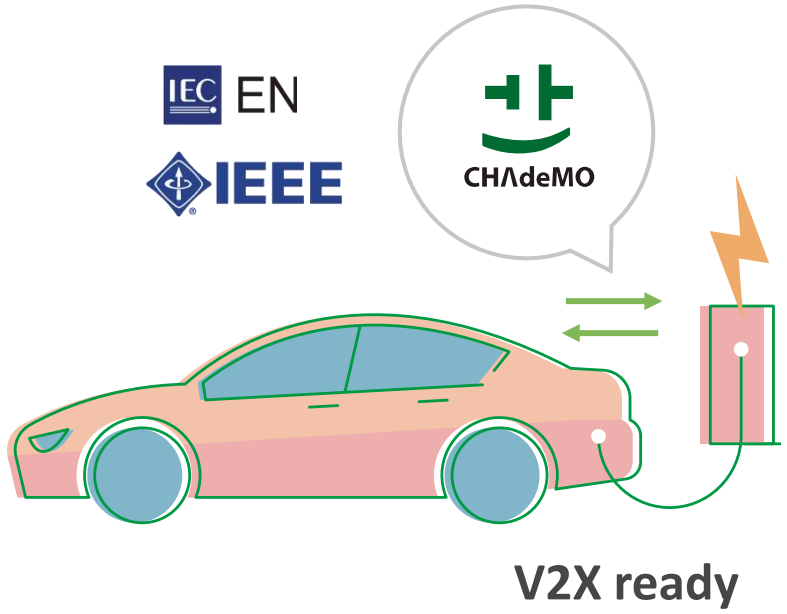
Agenda

- **CHAdeMO Basics**
- **Key factors for developing good charging infrastructures**
  - Safety as a core value of charging infrastructure
  - Other key factors
- **Case studies from Europe, Asia and the US**
- **Summary and proposals**



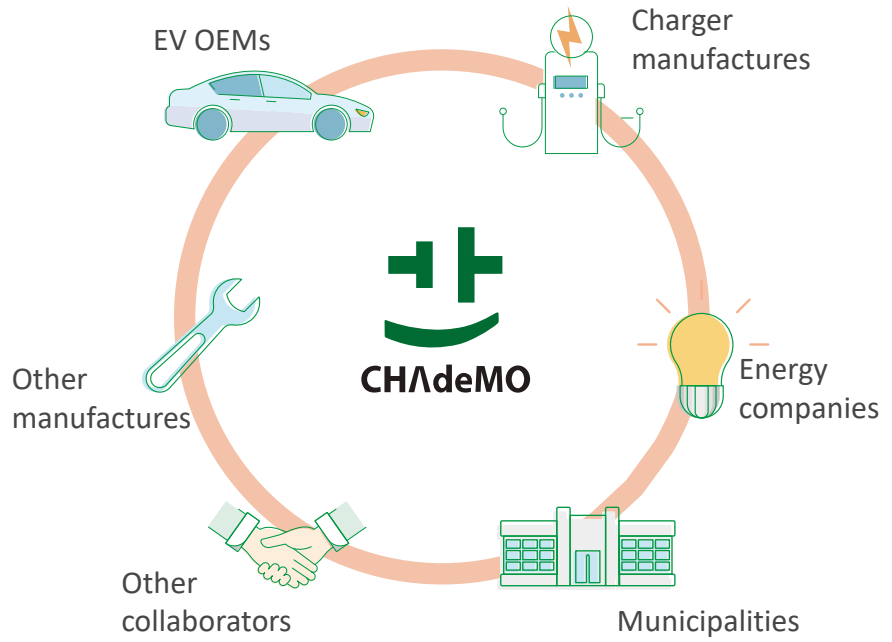
What's CHAdeMO?

DC charging Standard



V2X ready

Organisation



develop **certify** **promote**

Mission: Provide safe, affordable and interoperable charging experience to all EV users

CHAdeMO

Our members



And many, many more..

Our members:

502

entities from

47

countries

CHAdeMO

An international charging standard

	CHAdeMO (Global)	CCS 1 (US, Korea)	CCS 2 (EU)	GB/T (PRC)	TESLA (PROPRIETARY)
Connector					
Vehicle Inlet					
	✓	✓	✓	✓	
	✓	✓ (SAE)			✓ (UL)
	✓		✓		
	✓	✓	✓	✓	
	✓ (Reference)			✓	

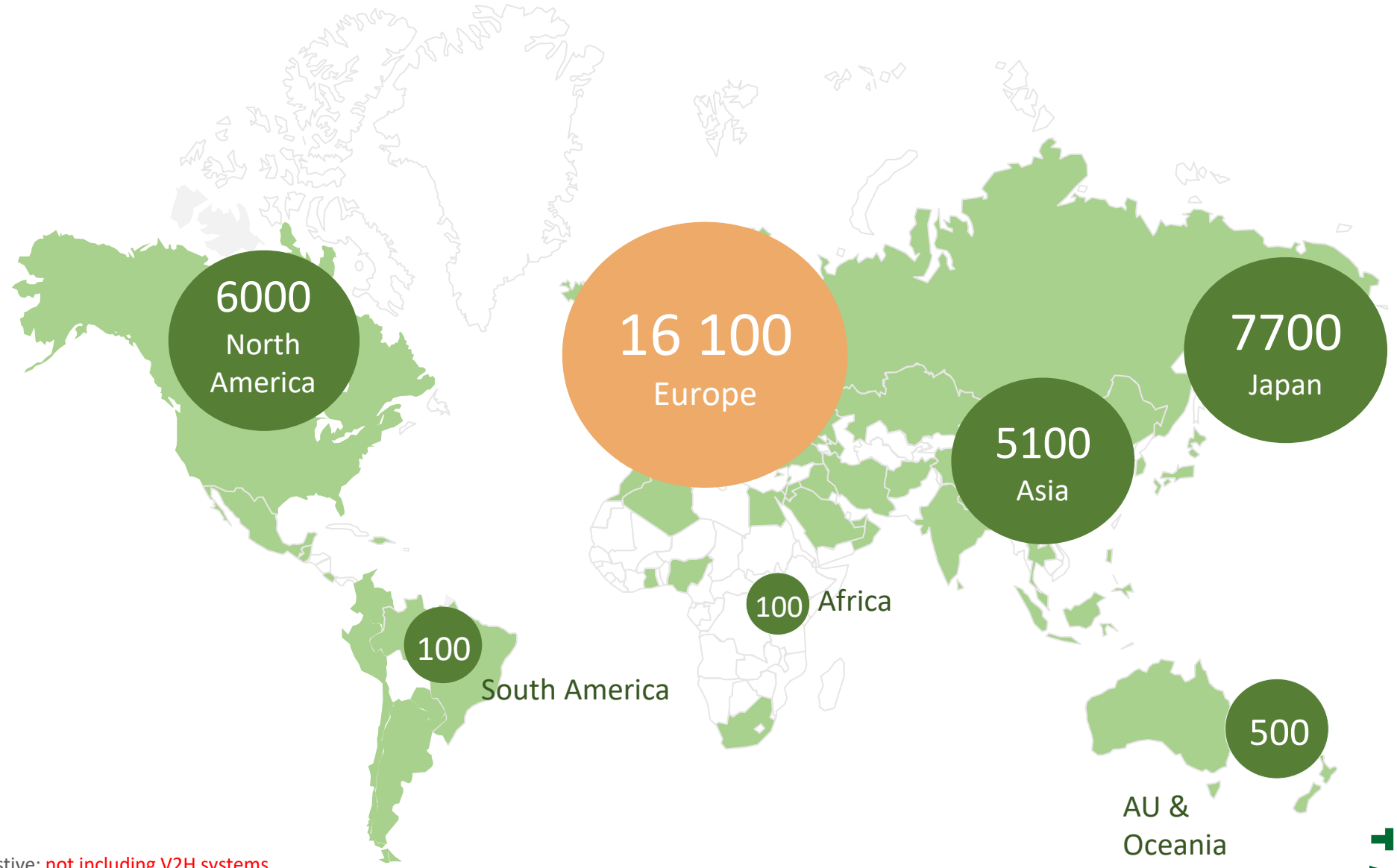
CHAdeMO

CHAdeMO global charge points

TOTAL

89 countries

35 600 charge points

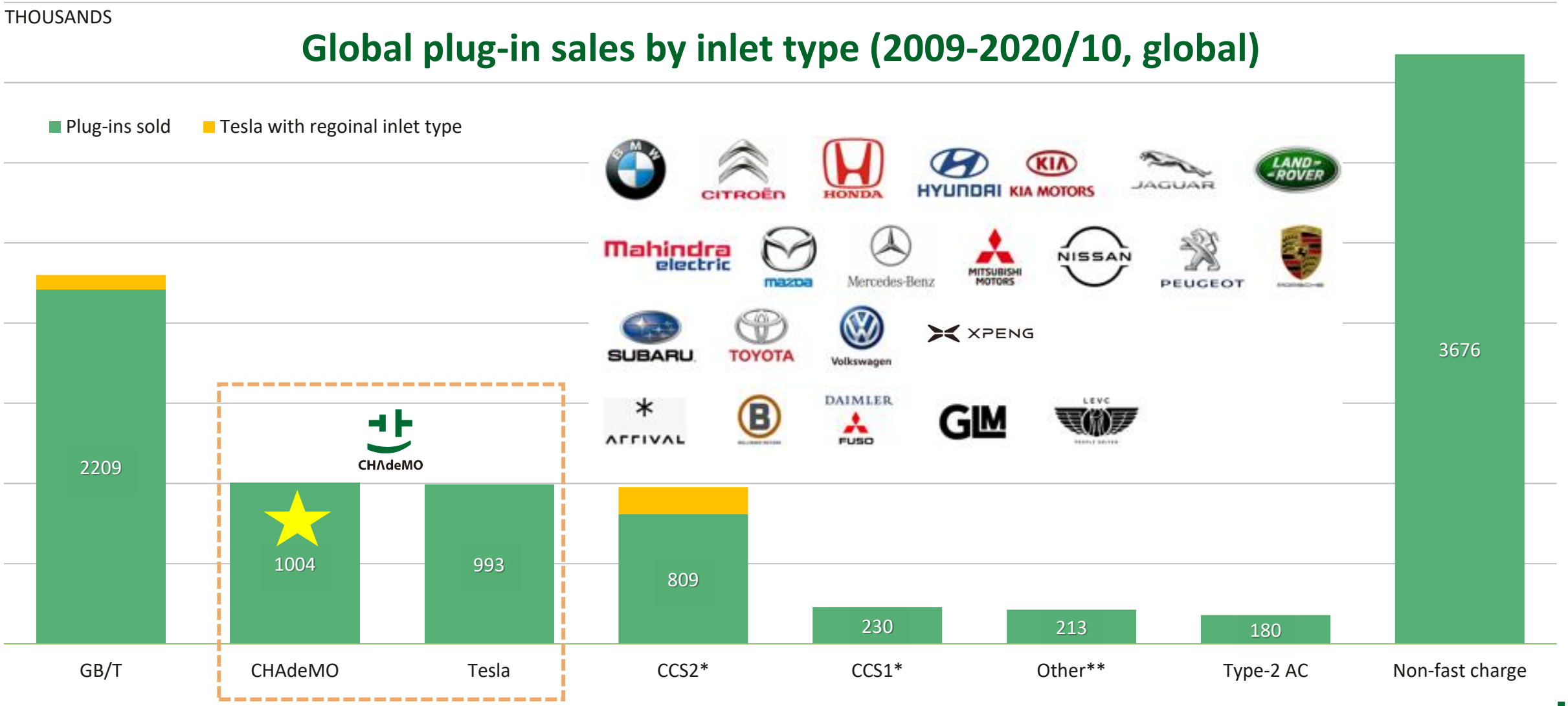


Note: as of Autumn 2020; not exhaustive; not including V2H systems

Source: ChargeMap, PlugShare, EAFO, Zap-Map, NOBIL, Girève, GoingElectric, ChargeHub

CHAdeMO

Serving 2 million CHAdeMO-compatible EVs

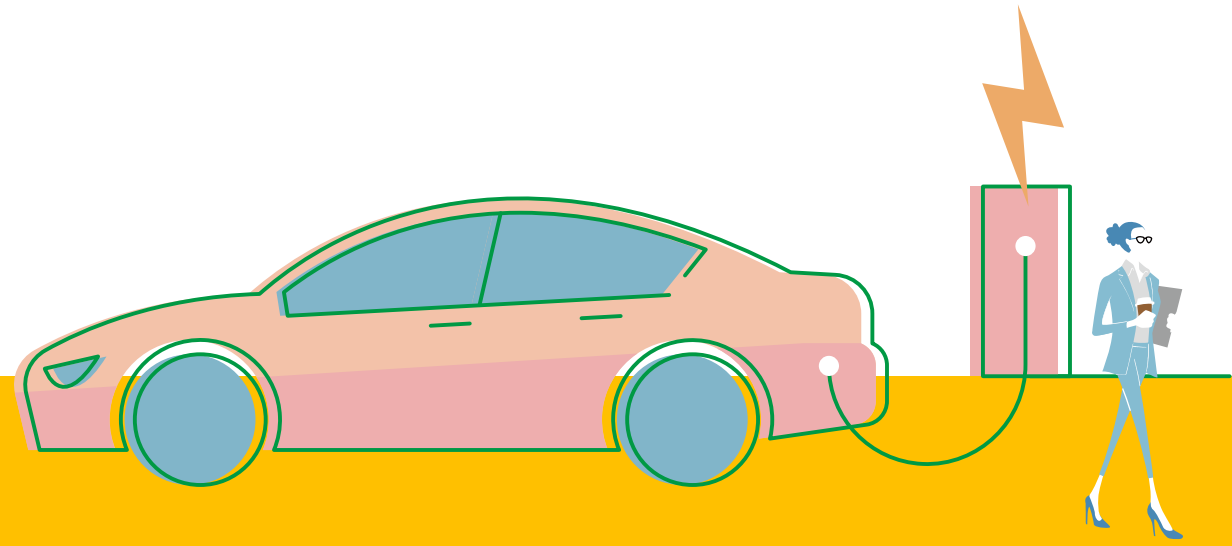


Source: EV-Volumes.com, BEV + PHEV, including LCV; Global total = 9.8 million vehicles (as of October 2020)
Note: *CCS1 and CCS2 breakdown unknown. We assumed the Americas = CCS1, Europe, Africa & ME = CCS2, and prorated the Asia Pacific (80K).
**Other includes unspecified, unknown, optional, and BYD.

EV VOLUMES.COM
THE ELECTRIC VEHICLE WORLD SALES DATABASE

Agenda

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Key factors for developing good charging infrastructure

Safety



Sustainability

Specification suitability

Viable business model



Localisation

Adapted to local needs

Certification

Interoperability



Innovation

Technically improved

These factors should be taken into account

CHAdeMO

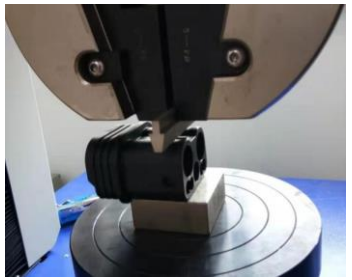
SAFETY is paramount for good charging infrastcruture

Charging infra must be:

- Resistant to high current heat-up
- Resistant to high voltage electrical shock
- Mechanically strong to support heavier cable & connector assembly, while optimising usability



Runover test



Crushing test



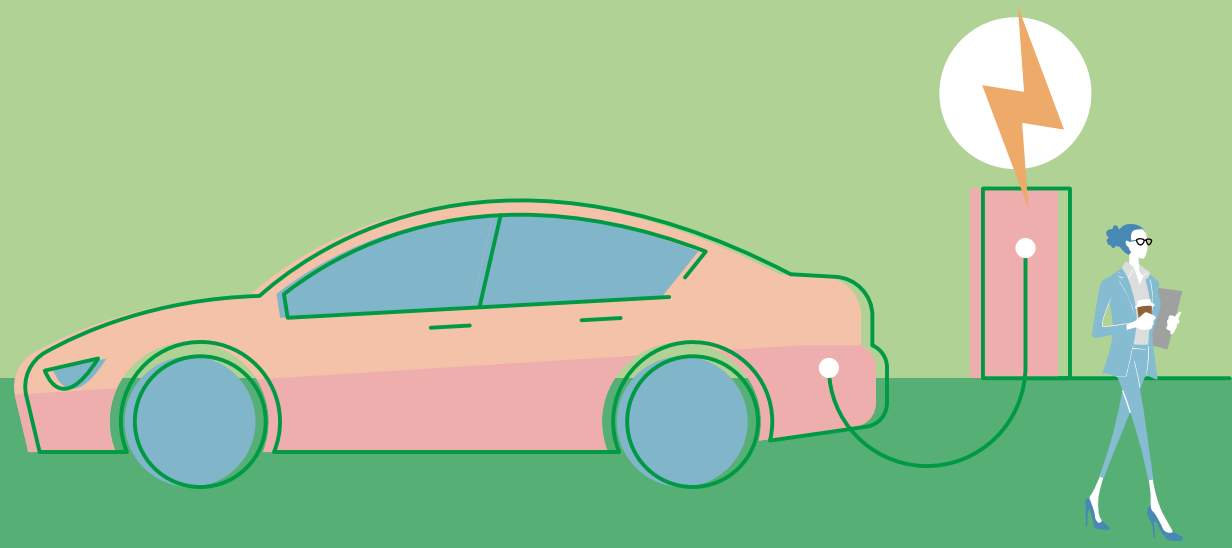
Drop test



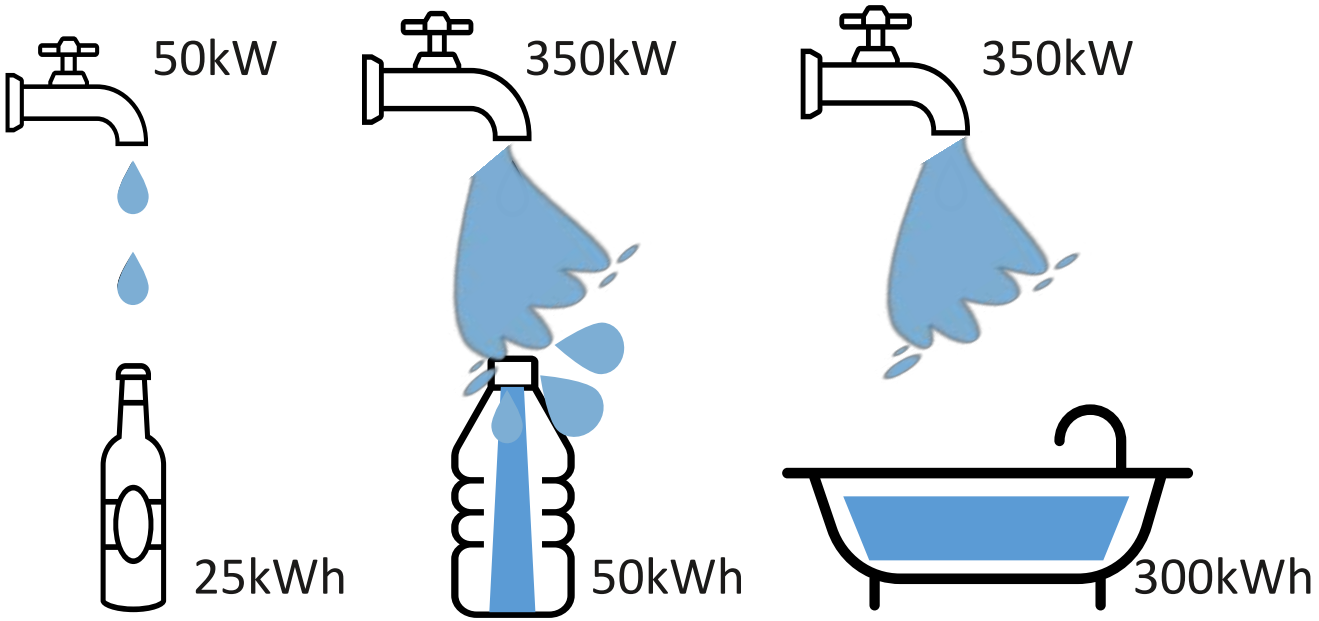
Impact–ball test

CHAdeMO has over a decade of impeccable safety record

SUSTAINABILITY



SUSTAINABILITY >> Specification suitability



Time for full charge

Battery Capacity	Charger power		
	50kW	150kW	350kW
25kWh	30 min	×	×
50kWh	1 hour	20 min	×
150kWh	3 hours	1 hour	30 min

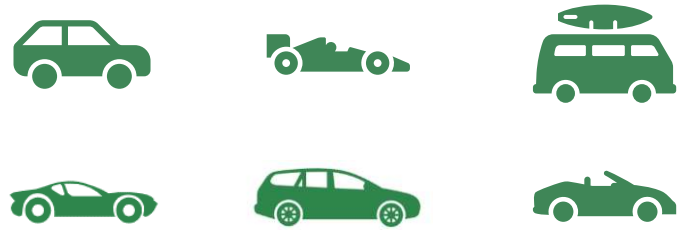
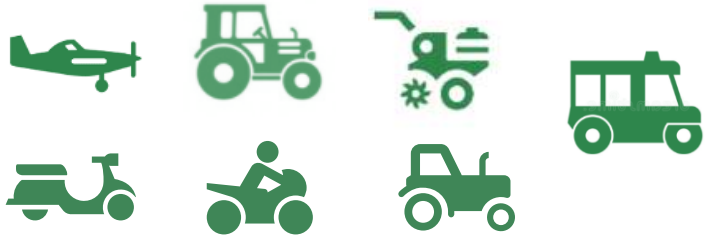
Ultra high-power charge is:

- Suited for buses and trucks but not for passenger cars (and dangerous for motorbikes)
- Costly (CAPEX/OPEX)

The higher the charge power is NOT necessarily the better

CHAdeMO

SUSTAINABILITY >> Specification suitability

	Power, battery size, place	Technology envisaged	Application examples
High power	▪ 350kW, 500kW+ ▪ Battery 100kWh+ ▪ @Dedicated base  	▪ Automated charge ▪ New plug and/or device	
Moderate power	▪ 50-150kW ▪ Battery 50kWh+ ▪ @Destination or en-route 	▪ Current plugs	
Low power	▪ 3-20kW ▪ Battery 2-10kWh ▪ @Home, depots 	▪ Smaller plugs ▪ Wireless charging	

CHAdeMO is robust and expandable for all the above

CHAdeMO

SUSTAINABILITY >> Viable business model

A good charging station:

- Minimises costs
- Maximises turnover

By:

- Providing chargers that can charge at the “right” power level
- Maximising customer value through meeting various charging (and waiting) needs
  - E.g., multi-standard charging
- Use of IT to enable smarter charging
- Etc…



Multi-standard charging

CHAdeMO is flexible and compatible with any adjacent systems (OCPP, etc.) or business models

CHAdeMO

SUSTAINABILITY >> Viable business model

Optimal location for siting charging stations



Japan



USA



Europe (NL)



China

Some examples:

- Shopping mall
- Parking lot
- Car dealer
- Gas station
- Drug store













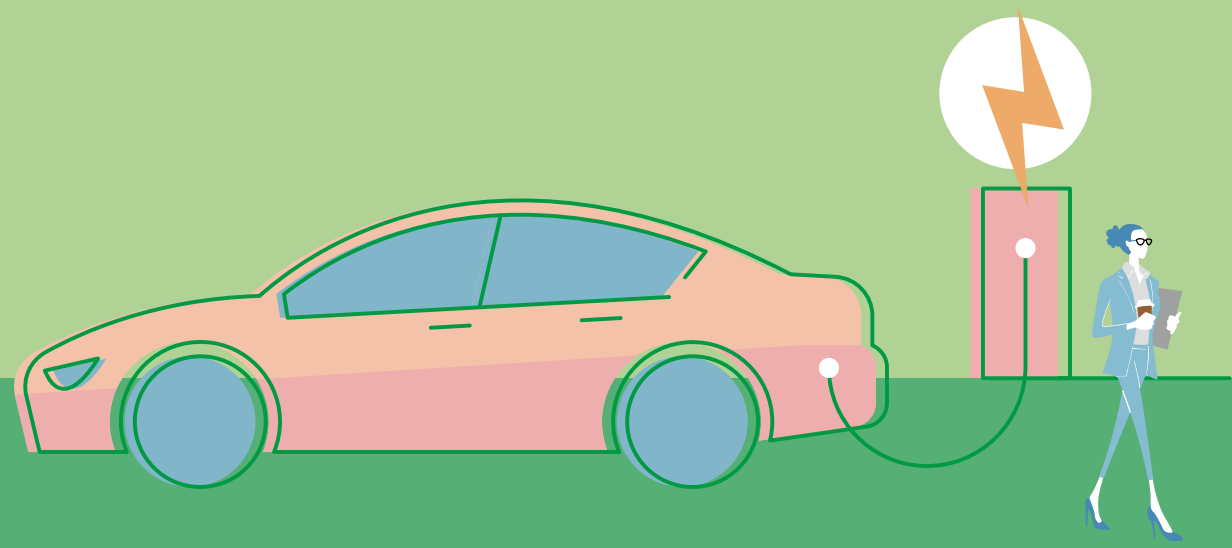


①Car Dealers;	2,283
②City Office:	301
③Roadside Stn	687
④SA・PA (Hwy):	391
⑤Shopping Mall:	391
⑥Hotels:	162
⑦Gas Stations:	66
⑧Stores:	1,032

457 of 7241

CHAdeMO

LOCALISATION



LOCALISATION

Why is localisation important?

Locally developed /manufactured chargers allow:

- knowledge and experience to remain in country for further industrial innovation
- ensuring quality after sales management
- local companies to minimise costs of development, manufacturing and logistics

How to implement it?

- Set up your own certification body at national /regional level
- Ensure interoperability across all electric vehicles and chargers



Plugshare.com

CHAdeMO

LOCALISATION>> Certification

Why certification is important

- Certification can ensure safety and interoperability which are key for good charging infrastructure
- Certification can support the development of locally made, operated, managed and reparable but globally conformed high-quality charging infrastructure

Independent certification body is important

Countries such as Russia, Canada, China are in the process for joining CHAdeMO's certification network

TÜVRheinland, JET, TERTEC REAL TIME SYSTEMS, UL, Applus IDIADA, TÜV SÜD, ktl, ARAI Progress through Research, DEKRA Alles im grünen Bereich.

CHAdeMO has installed a global certification network to ensure reliable, flexible, fair, convenient, and market-oriented certification procedure.

CHAdeMO

LOCALISATION >> Interoperability

Interoperability across any CHAdeMO vehicles and chargers needs to be guaranteed



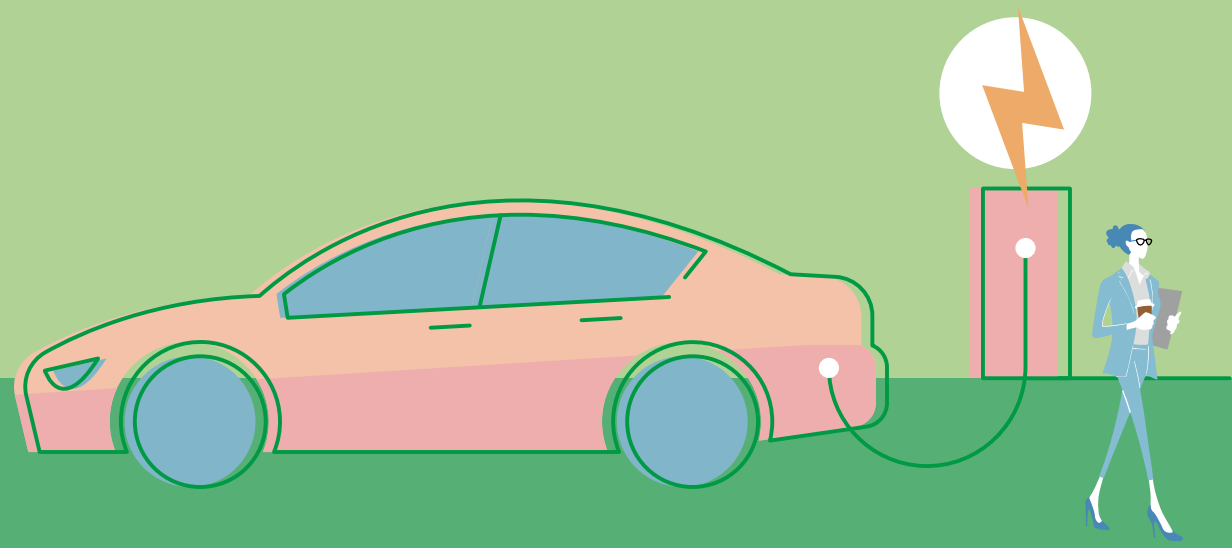
X



CHAdeMO ensures this through its unique certification system

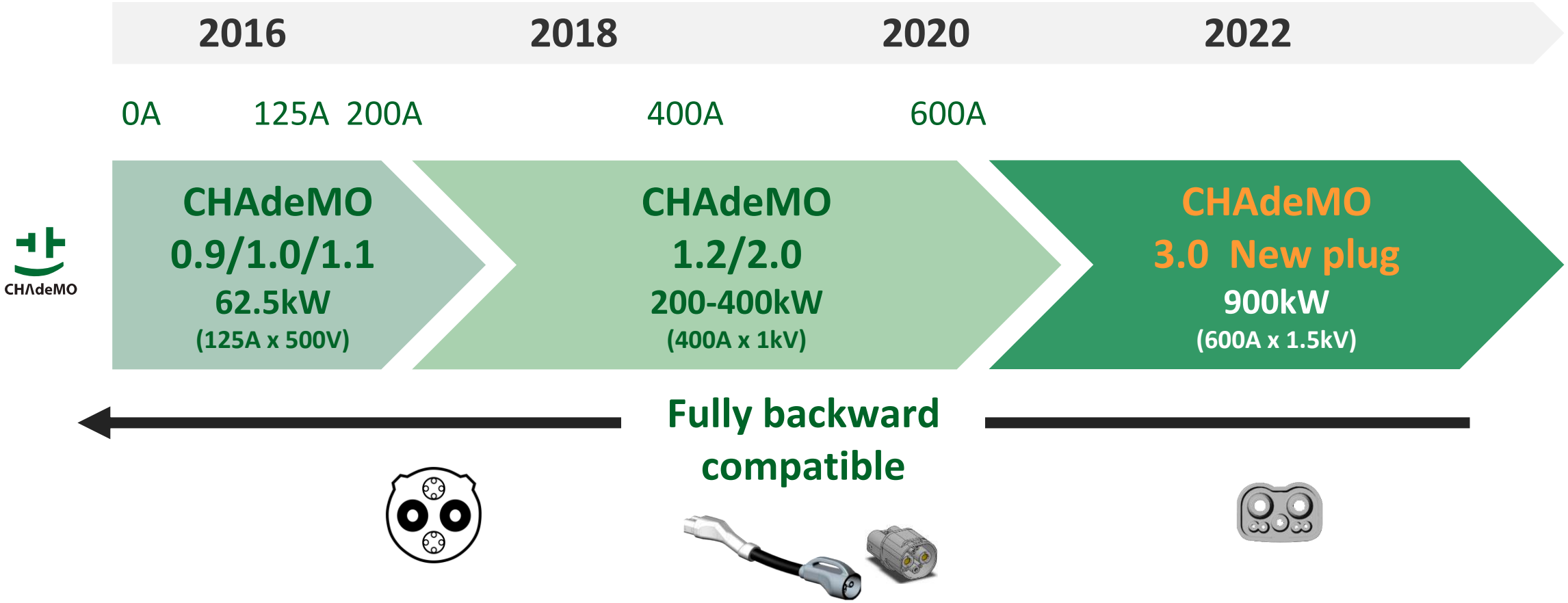
CHAdeMO

INNOVATION



INNOVATION>> High Power

Standards need maintenance and evolution



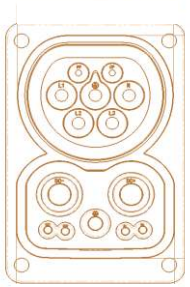
CHAdeMO evolves with full backward compatibility

INNOVATION >> ChaoJi 2/CHAdeMO 3.0

500+kW
(600A x 1kV)



- High power charging suitable for trucks and buses
- Maximum current of 600A with liquid cooling
- Simple, light and compact connector
- Backward compatible with CHAdeMO, GB/T and CCS
- V2G and PnC ready
- Optional combo-style inlet (AC type-1, -2 and GB/T-AC)
- To be released this month



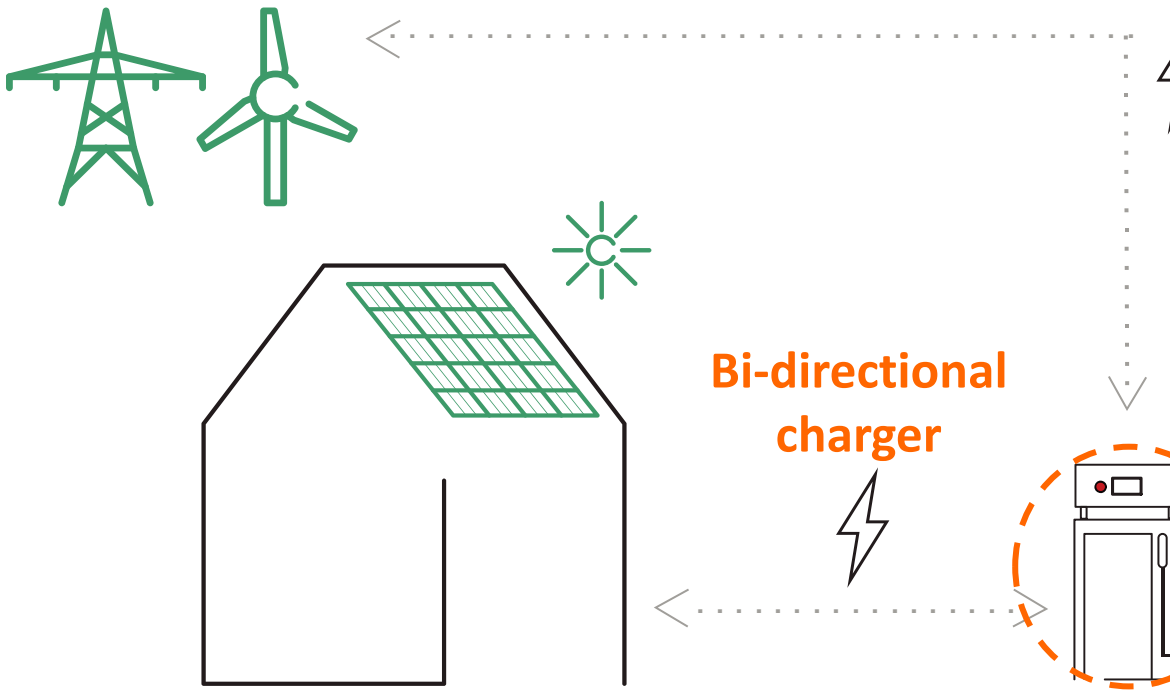


CHAdeMO 2.0 (left) vs 3.0

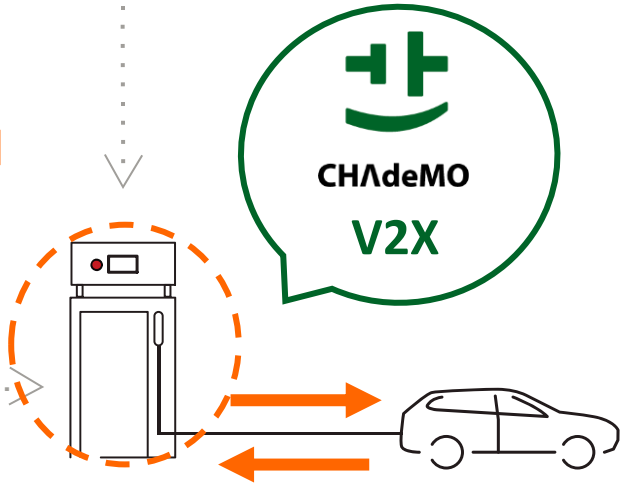
CHAdeMO 3.0 enables 5-minute charge for 400 km

CHAdeMO

INNOVATION>> V2G



Bi-directional charger



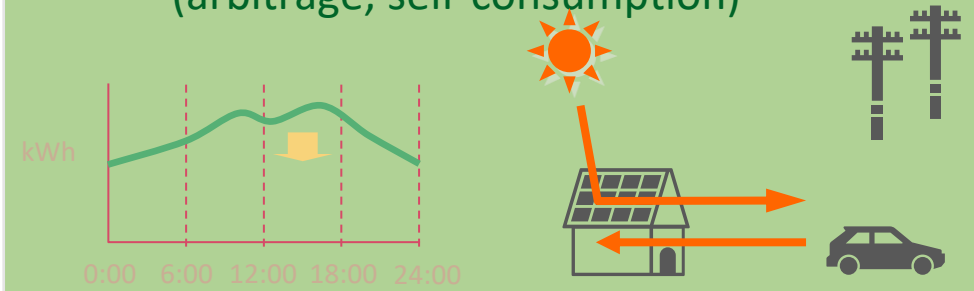
V2G

Typically up to **10kW**

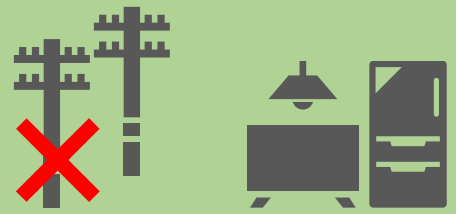
Enabler of greener grid towards a carbon-neutral society

Micro-grid optimisation

(arbitrage, self-consumption)

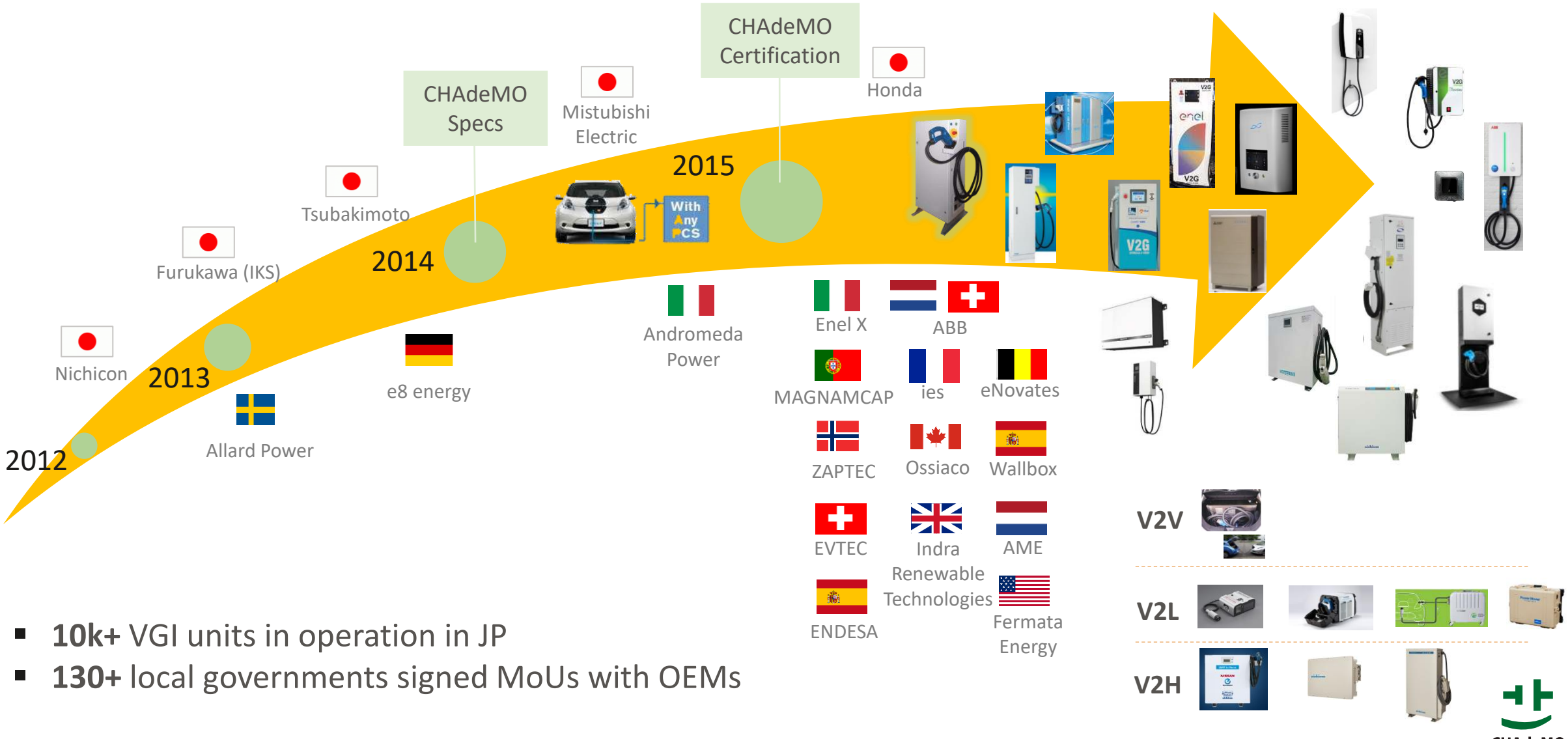


Back-up for blackout



CHAdeMO

Innovation>> V2G



- **10k+** VGI units in operation in JP
- **130+** local governments signed MoUs with OEMs

Innovation>> V2G



Great East Japan Earthquake 2011

- 66 LEAFs were temporarily provided for local government use
- Electricity recovery was faster than any other utility infrastructure

CHAdeMO is the only standard that defined V2X with readily available products



Island smart grid project in Hawaii



EV battery packs with PV on Amsterdam's Johan Cruijff Arena

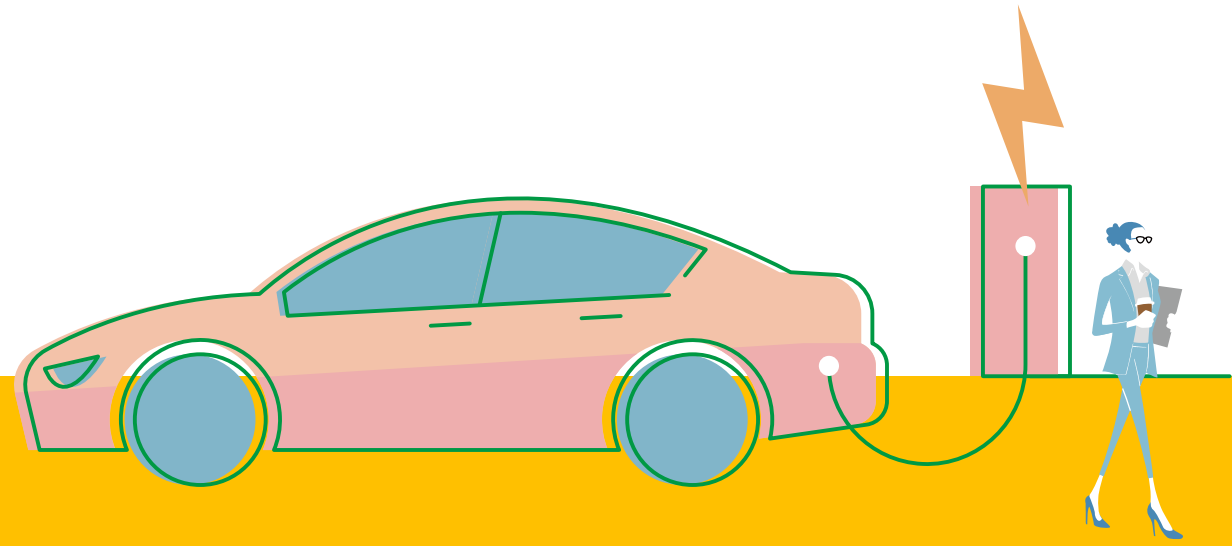


Affordable and sustainable energy for Singapore's isolated territories

CHAdeMO

Agenda

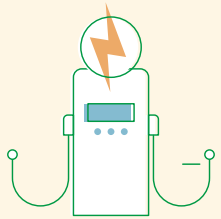
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EU charging standard case study in EU

Alternative Fuels Infrastructure Directive (AFID, 2014)

- Binding targets for member states (MS)
  → MS to set own targets
- Minimum plug standards
  → **'at least' Type2** (AC) and **CCS** (DC)
  but 'allowing multistandard charging'

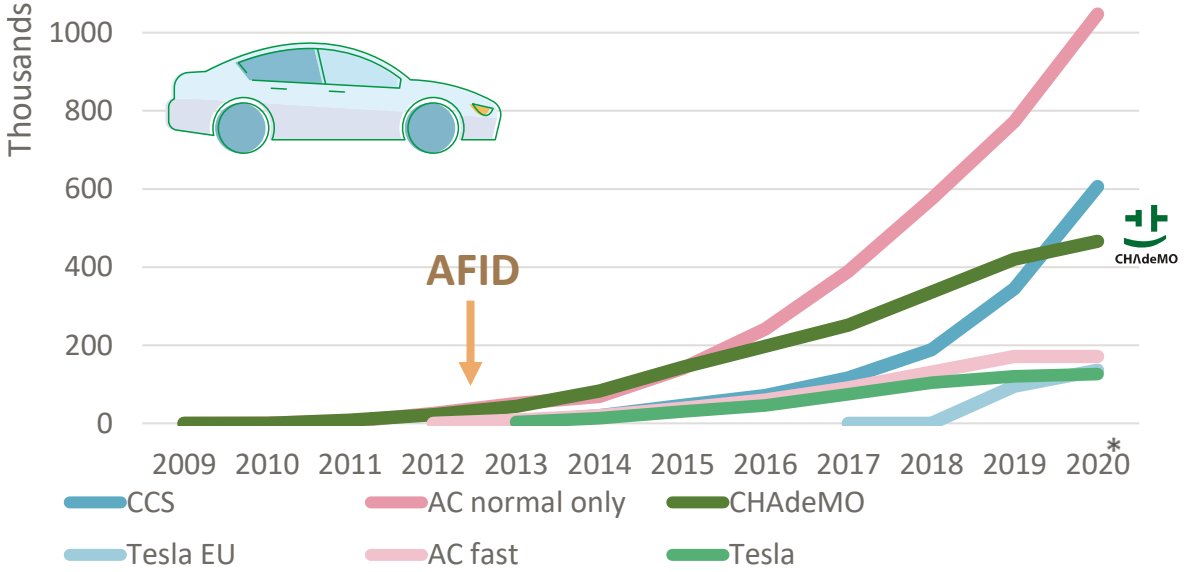


Multistandard became the *de facto* fast charging standard to serve all types of EVs

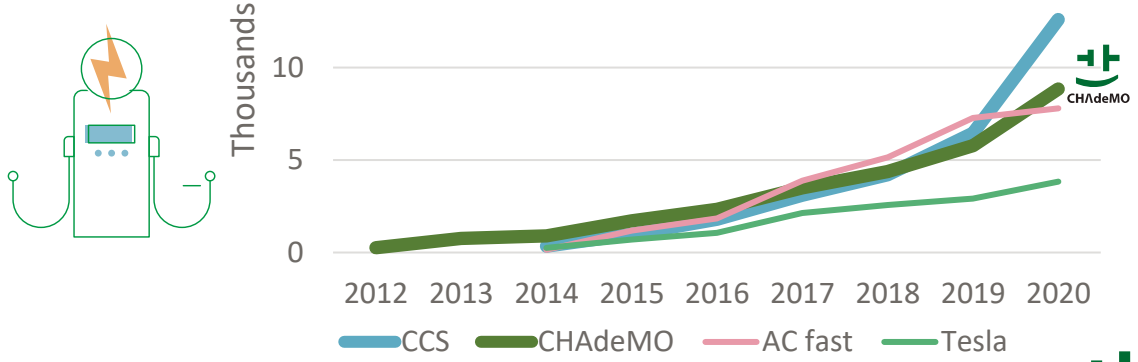
Today

- Various charging systems co-exist
- The biggest # of vehicles have **AC normal port** only
- **CCS** vehicles and chargers are growing rapidly
- **CHAdeMO** continues its steady growth

EU plug-in vehicle sales by charging port type



EU DC fast charging points by type

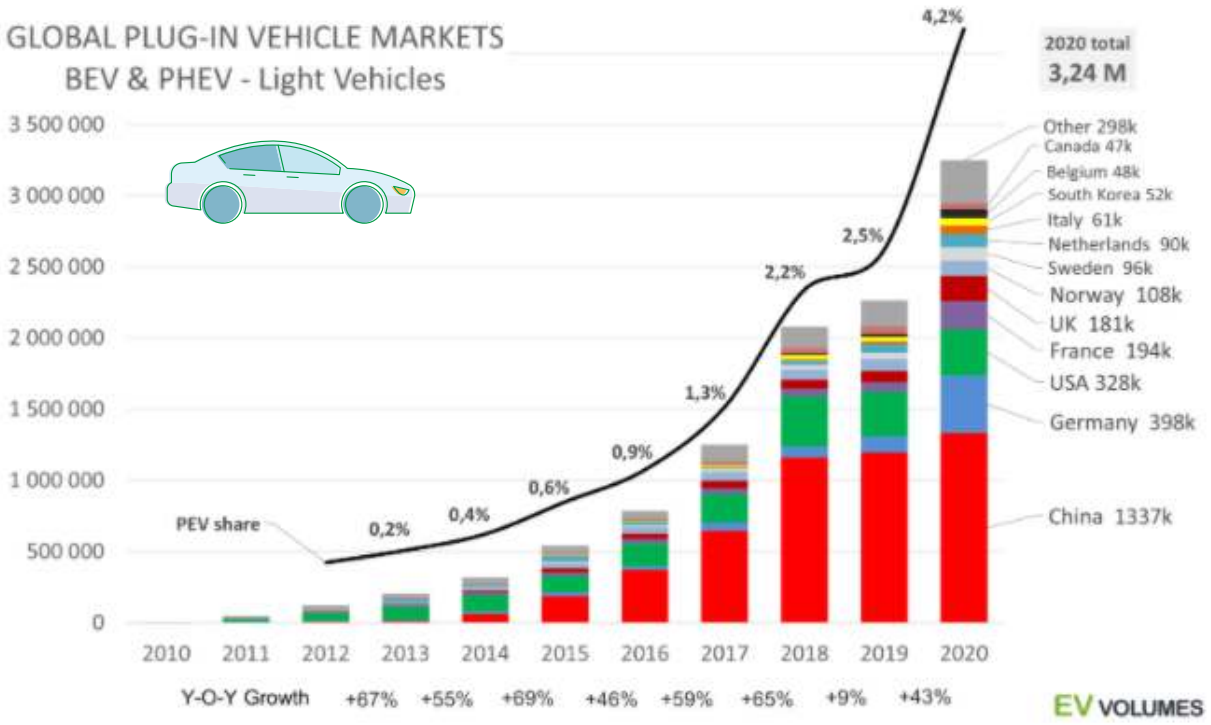


Source: EV-volumes.com for vehicles; *data as of Aug 2020 and 2020 data includes Jan-Aug only; EAFO.eu for chargers; both cumulative

Europe overtakes China as the biggest EV market in 2020

EU captured 43% of global new plug-in sales in 2020

- Factors:
  Strict CO2 emissions mandate, incentive boosts by green recovery funds (EV & chargers), new vehicle models



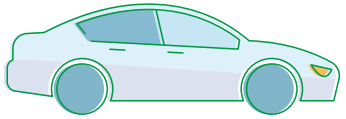


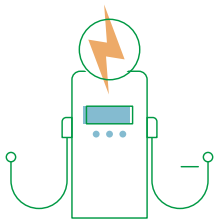
Source: EV-Volumes.com (http://www.ev-volumes.com/news/86364/), https://ec.europa.eu/clima/policies/transport/vehicles/cars_en

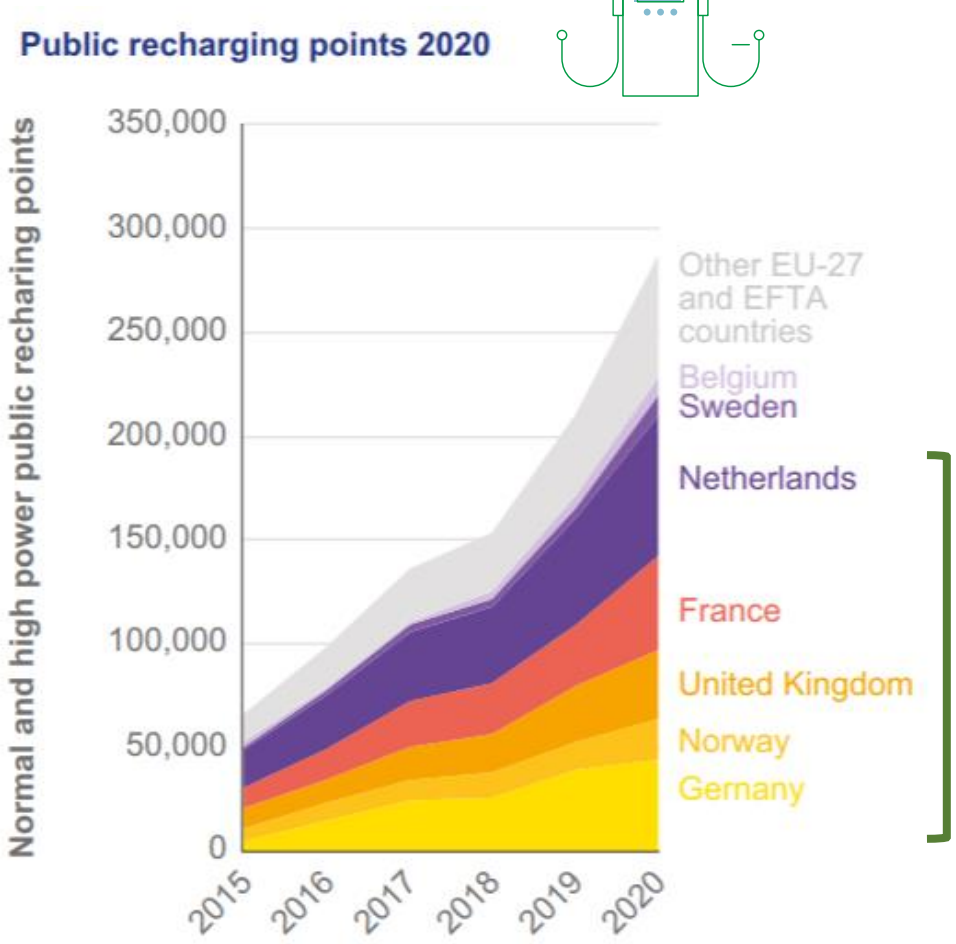
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… but e-mobility deployment is concentrated in a handful of markets

70% of EVs and 73% of public charging points in EU are found in 5 countries



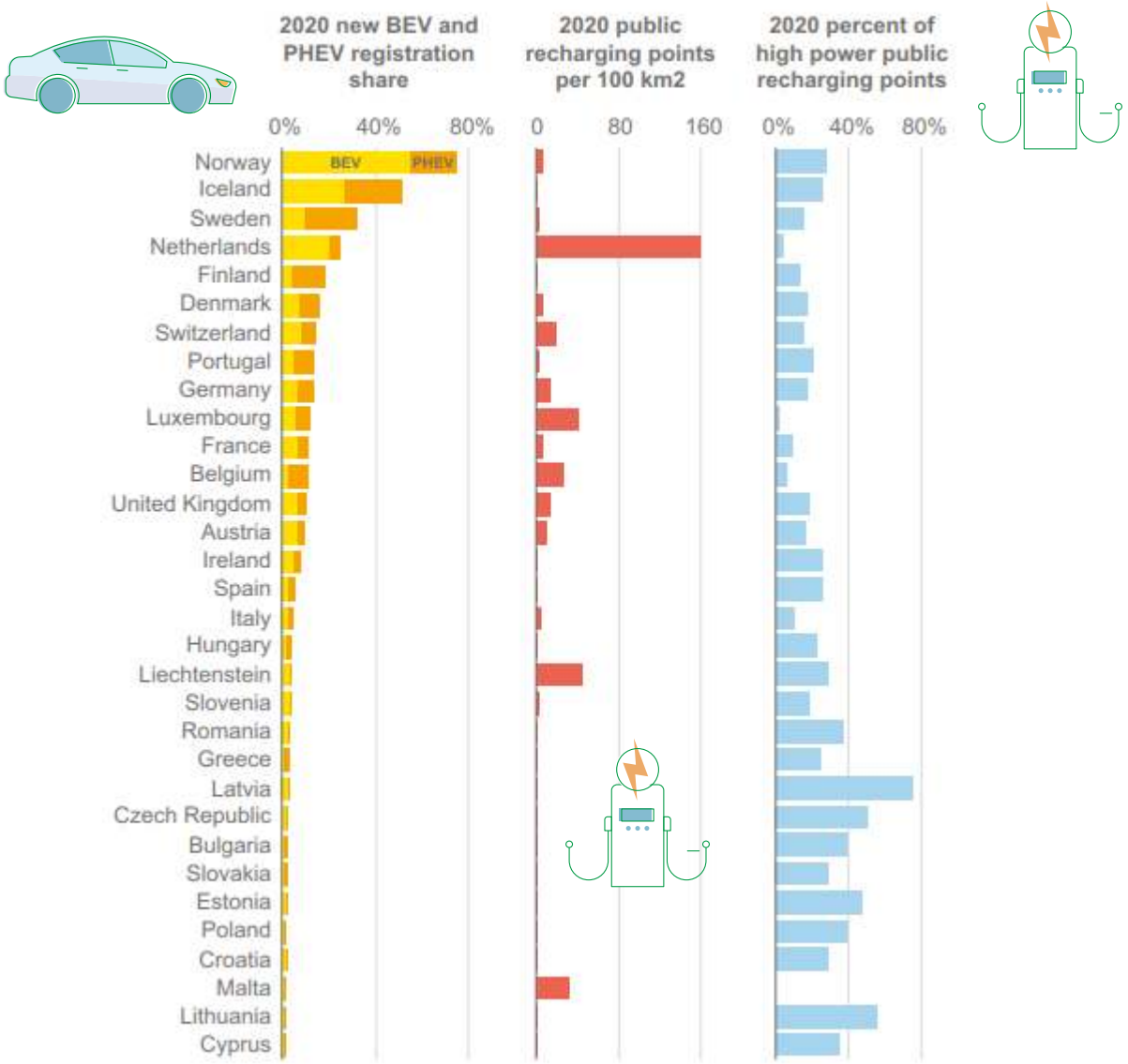




Source: EAFO policy paper: Europe on the electrification path towards clean transportation, March 2021, https://www.eafo.eu/
Data as of December 2020

CHAdeMO

… each market has its own situation and there is no ‘one-size-fits-all’ solution



EU countries made different choices that they found best suited for their specific situation

Take-aways:

- Subsidies help boost the market
- If mandating standards, the market reality and trust should be considered
  - Beware of premature mandates, which may freeze investments
  - Mandate only the essential standards (e.g., user safety) and provide a level playing field
  - Leave plenty of room for innovation

Going forward:

The European Green Deal:

‘1 million charging points for 13 million EVs by 2025’

AFID to be revised this year to dial up the ambition for more coherent e-mobility uptake

Source: EAFO policy paper: Europe on the electrification path towards clean transportation, March 2021, https://www.eafo.eu/
European Commission, The European Green Deal (2019)

CHAdeMO

Case studies from Asia



Indonesia

- CHAdeMO to provide training to empower the certification body



India

- CHAdeMO to support India's efforts of developing India specific DC charging standard based on the CHAdeMO technical specifications



Singapore

- CHAdeMO remains as the de fact standard in Singapore despite the legislative mandating of CCS use

CHAdeMO can help you in advancing the EV uptake and industry development fully adapted to your country's needs and specificities

CHAdeMO

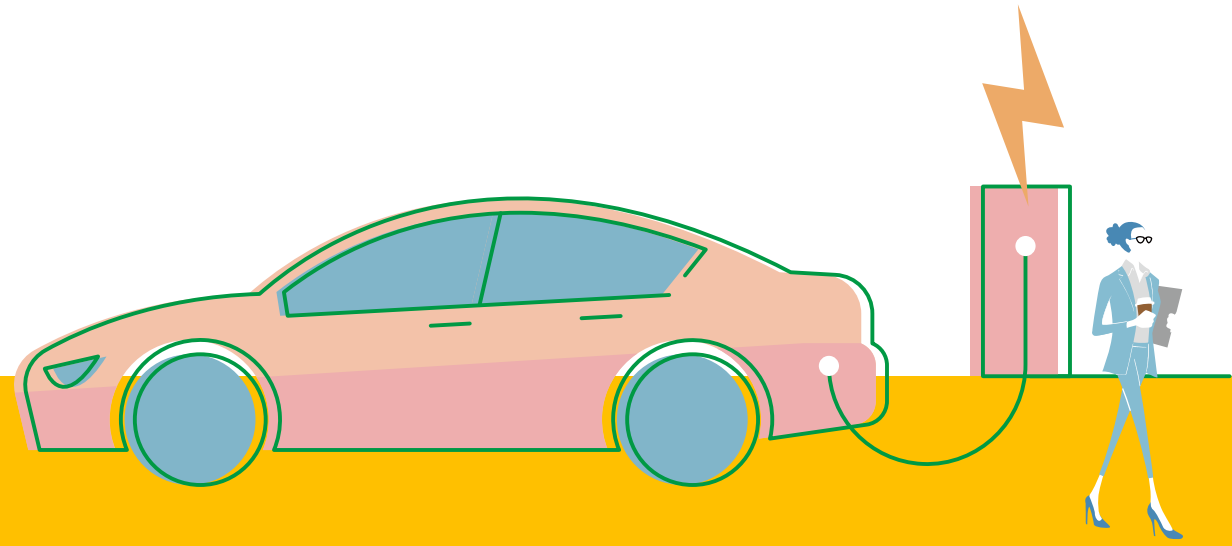
Case studies from the North America

- CHAdeMO cooperating with Tesla and IEEE is trying to deploy EV Charging infrastructure into North America with technical neutrality
- CHAdeMO has an identical standard and common certification system with IEEE (2030.1.1)
- CHAdeMO compatible vehicle are the most popular in North America (Tesla, Nissan, Mitsubishi, and so on)
  More than a million EV with the compatibility now
- CHAdeMO to pioneers V2X technology in the North American market
  (only CHAdeMO can do V2X, Tesla will do near future)

CHAdeMO

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Summary

- **Define appropriate standards** in accordance with sustainable and market-oriented specs
- **Localise** the whole business with **safety & quality assurance** and future innovation potential
- **Set supportive policy** and regulatory framework to foster the sound development of e-mobility ecosystem

CHAdeMO advantages:

- Technical safety
- Local needs adaptability
- Certification system in place
- Interoperability
- V2G-enabled
- High power enabled

CHAdeMO

Proposals:

CHAdeMO can help you:

- In developing your nation-/region-wide certification scheme
- In empowering the local authority and opening intellectual property
- In defining technical specifications adapted to local needs
- Through our regional offices, global help desk & training programme in planning

Thank you

Contact: info@chademo.eu

