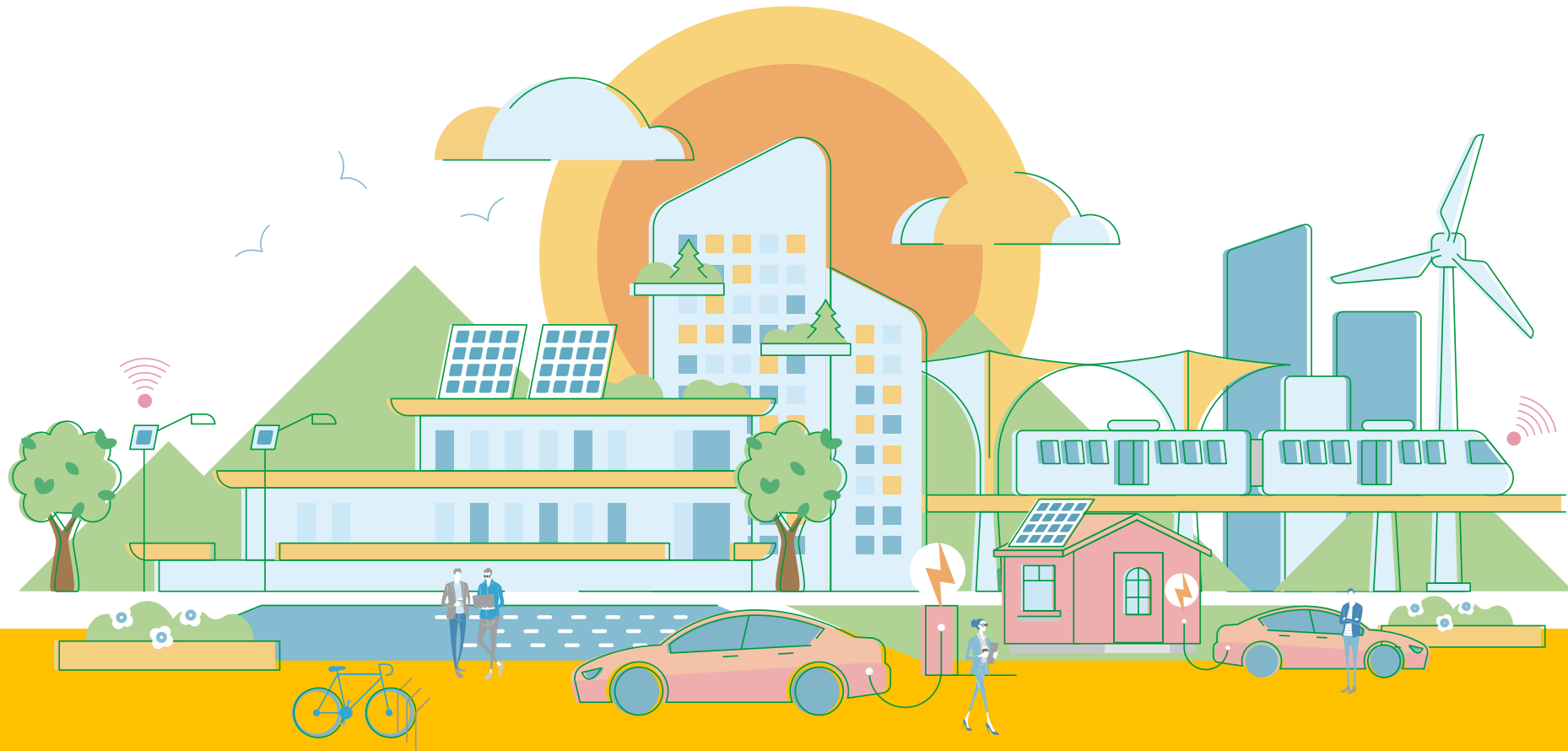


Successful transition towards nation- and region-wide zero-emission transport systems

13 April 2021

Makoto Dave Yoshida & Tomoko Blech

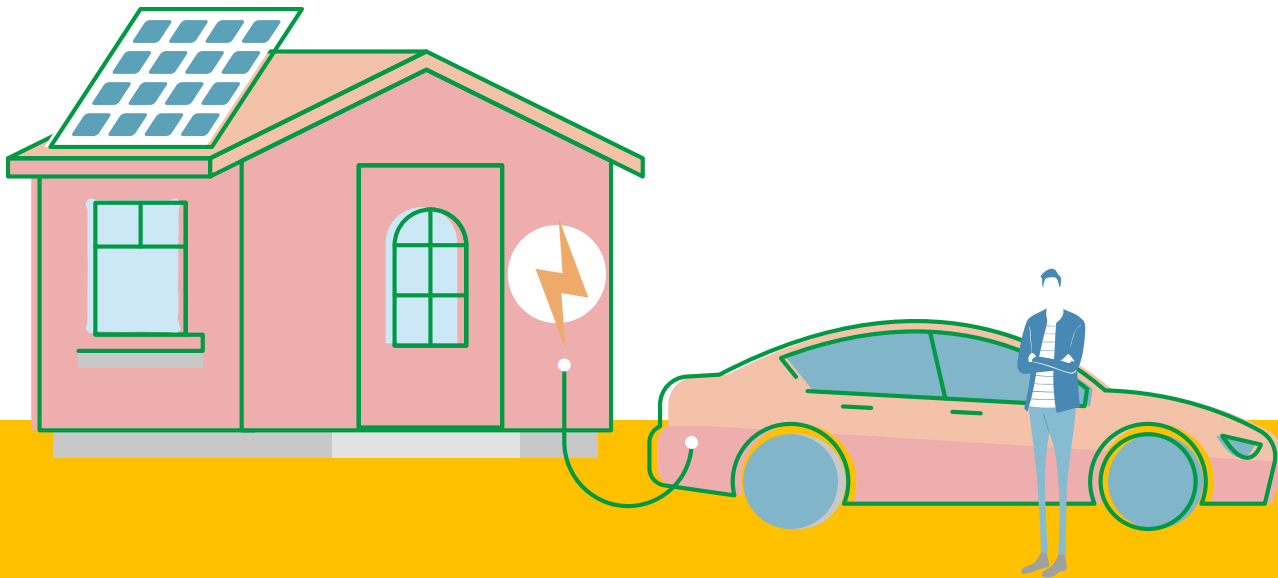
CHAdEMO Association



The seminar objectives:

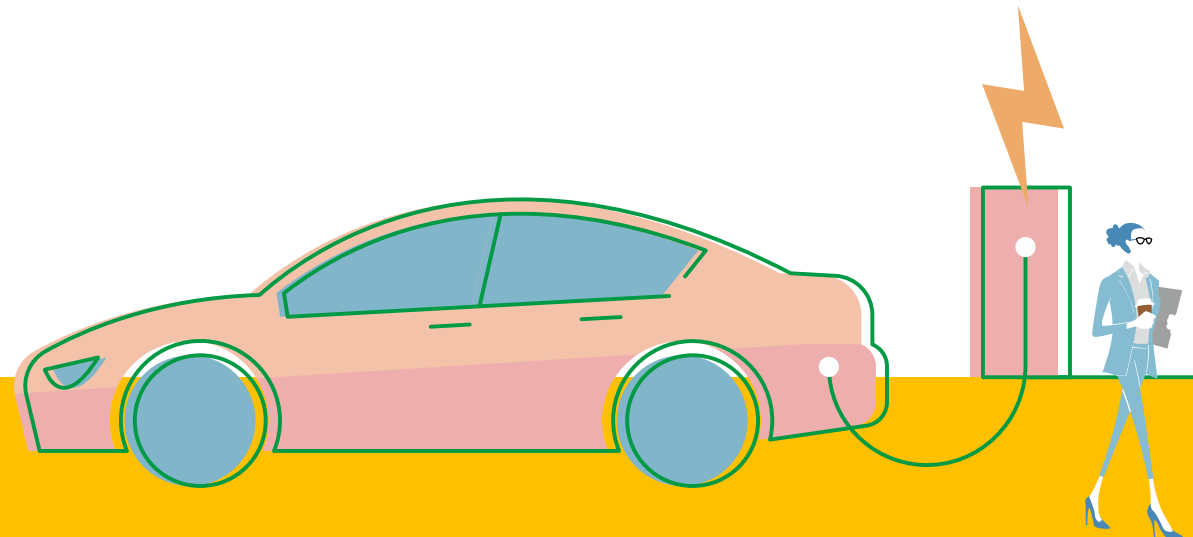
You will:

- 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



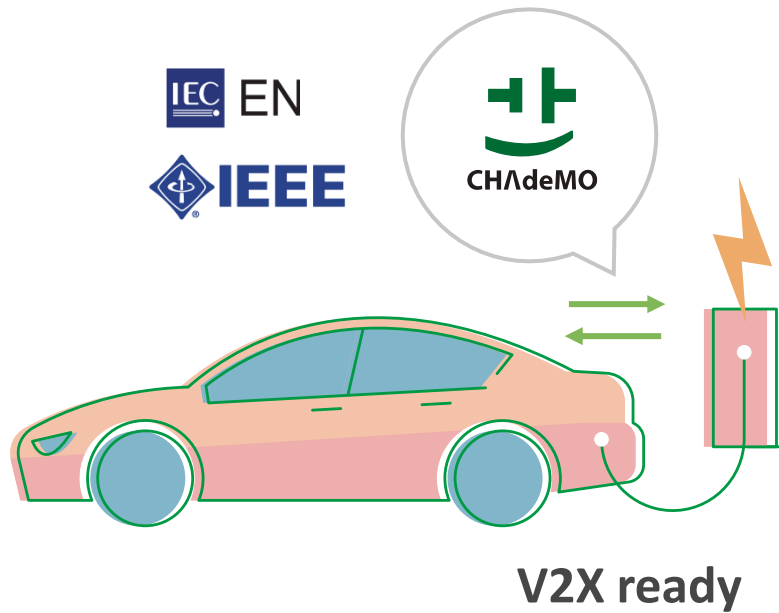
Agenda

- 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

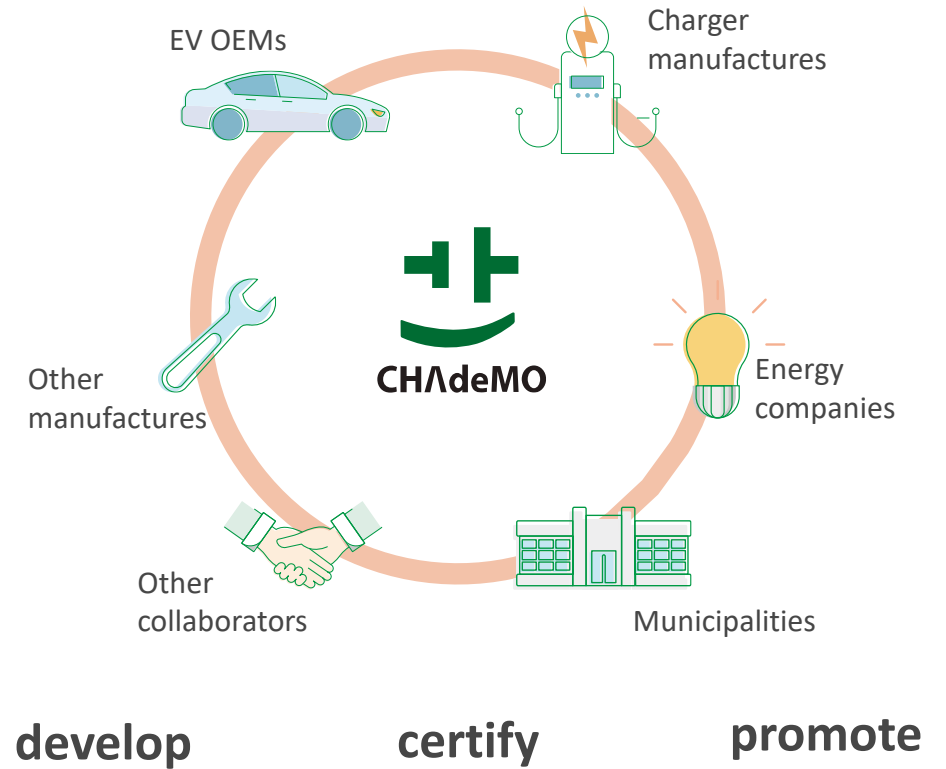


What's CHAdeMO?

DC charging Standard



Organisation



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

Our members



Our members:

502

entities from

47

countries

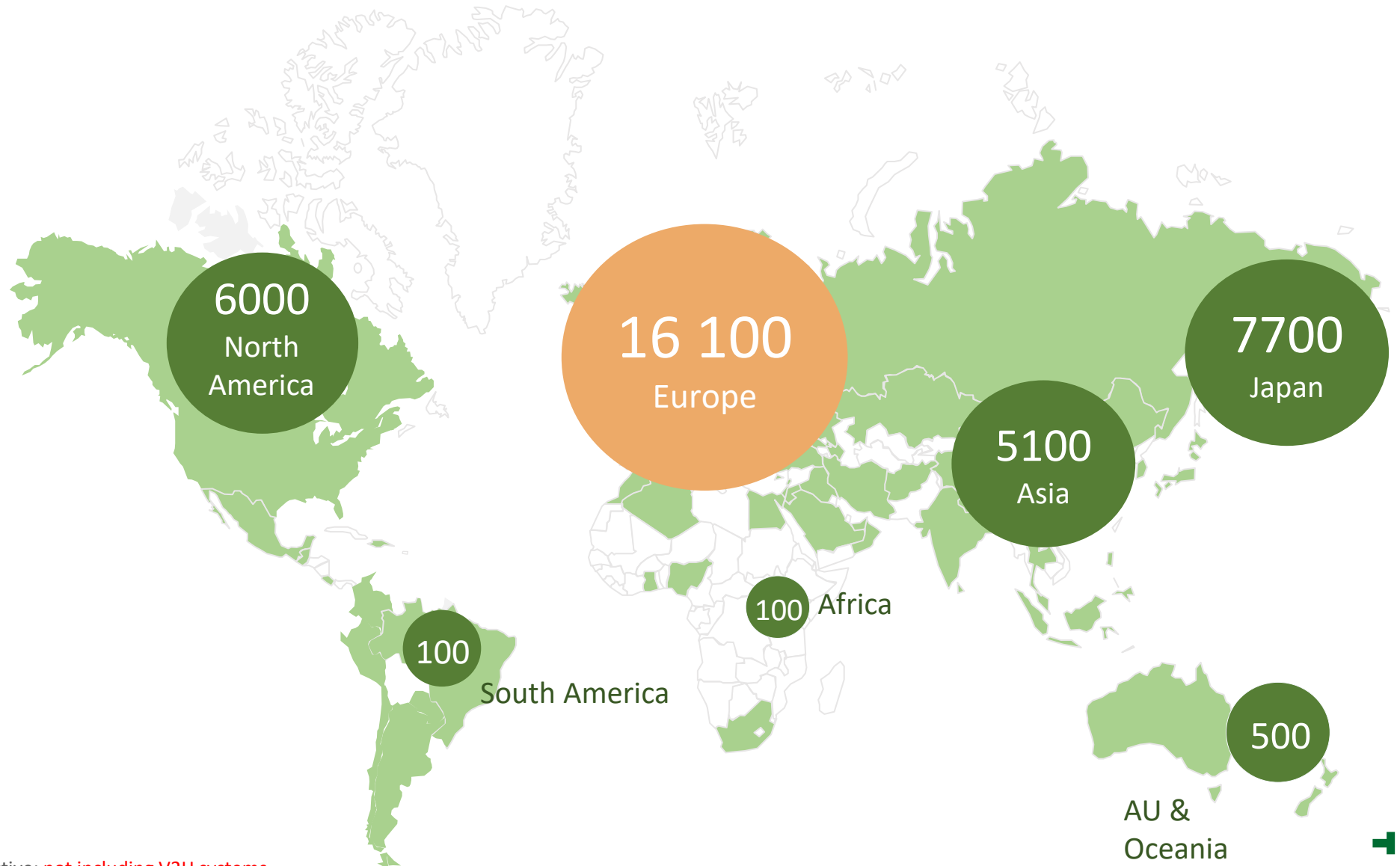
And many, many more..

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 global charge points

TOTAL
89 countries
35 600 charge points



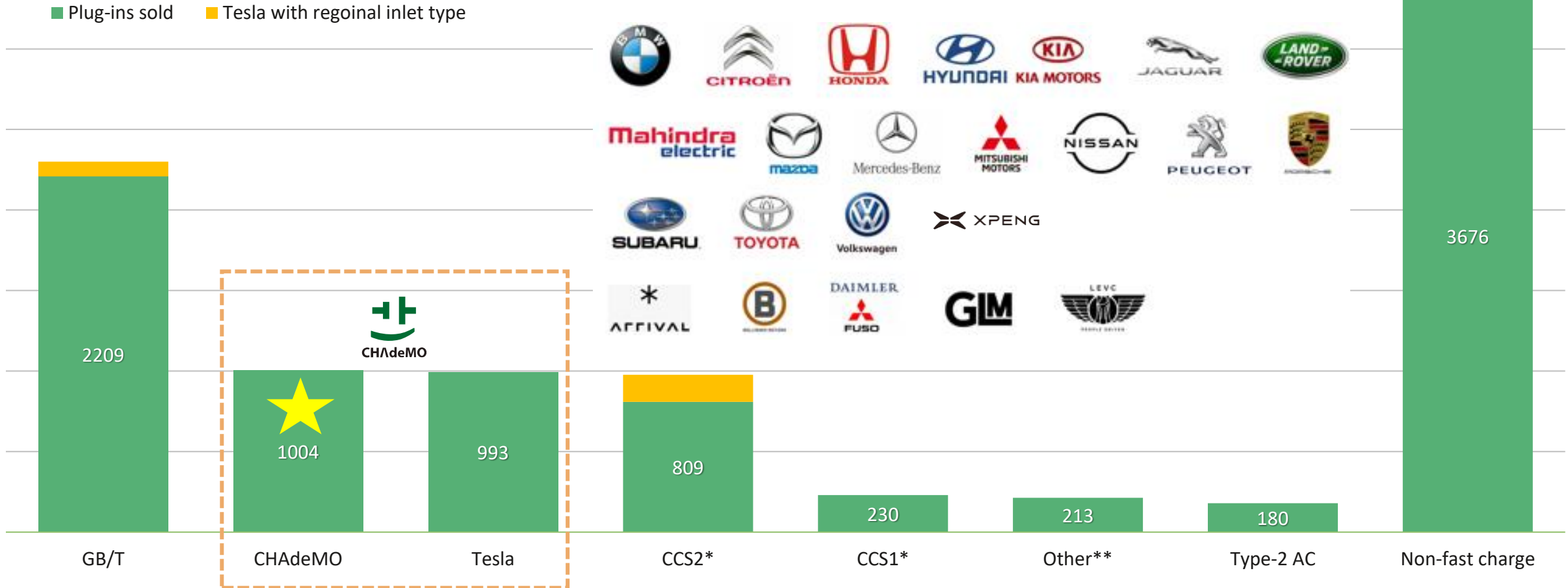
Note: as of Autumn 2020; not exhaustive; **not including V2H systems**

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

Serving 2 million CHAdeMO-compatible EVs

THOUSANDS

Global plug-in sales by inlet type (2009-2020/10, global)



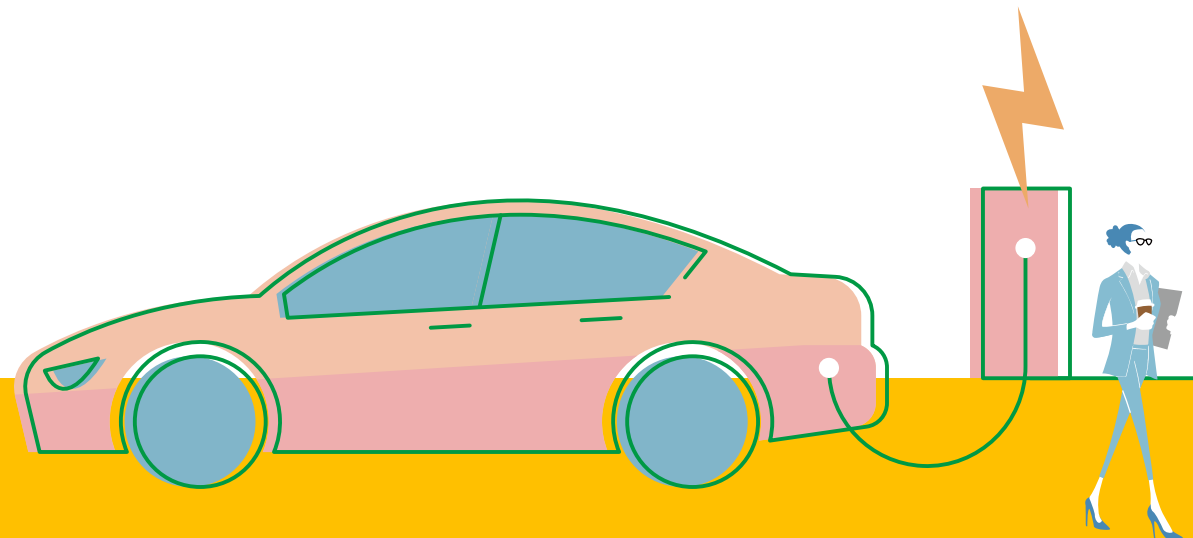
Source: EV-Volumes.com, BEV + PHEV, including LCV; Global total = 9.8 million vehicles (as of October 2020)

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.

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

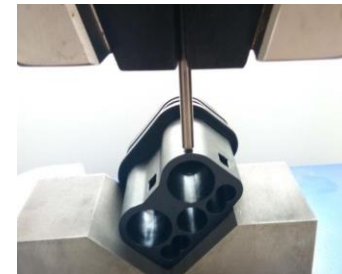
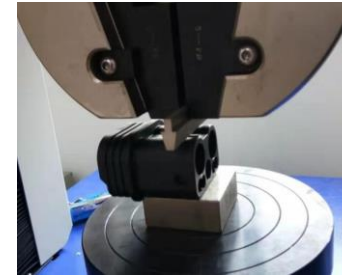
SAFETY is paramount for good charging infrastructure

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



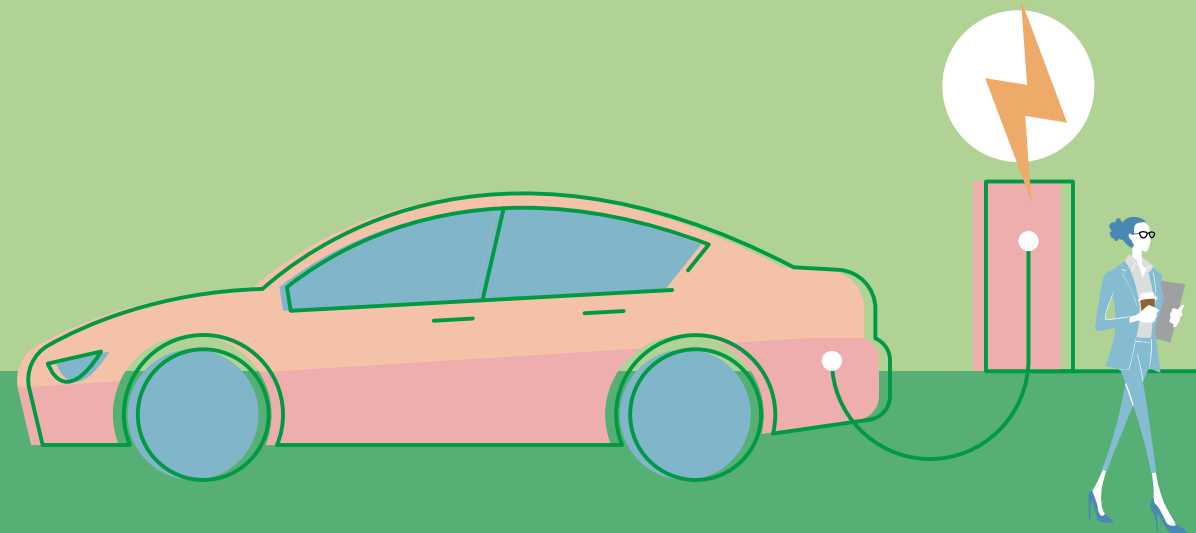
Drop test



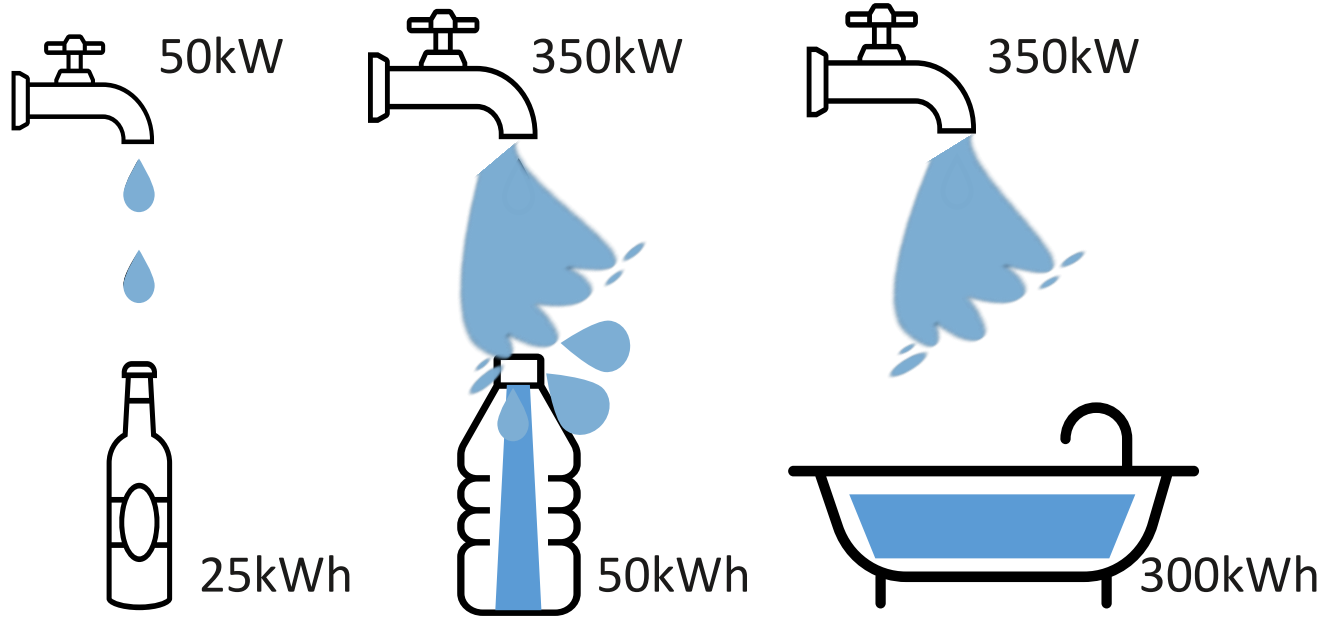
Impact-ball test

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

SUSTAINABILITY >> Specification suitability

| | Power, battery size, place | Technology envisaged | Application examples |
|----------------|---|--|--|
| High power | <ul style="list-style-type: none"> 350kW, 500kW+ Battery 100kWh+ @Dedicated base  | <ul style="list-style-type: none"> Automated charge New plug and/or device |  |
| Moderate power | <ul style="list-style-type: none"> 50-150kW Battery 50kWh+ @Destination or en-route  | <ul style="list-style-type: none"> Current plugs |  |
| Low power | <ul style="list-style-type: none"> 3-20kW Battery 2-10kWh @Home, depots  | <ul style="list-style-type: none"> Smaller plugs Wireless charging |  |

CHAdeMO is robust and expandable for all the above

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

SUSTAINABILITY >> Viable business model

Optimal location for siting charging stations



Japan



USA



Europe (NL)



China

Some examples:

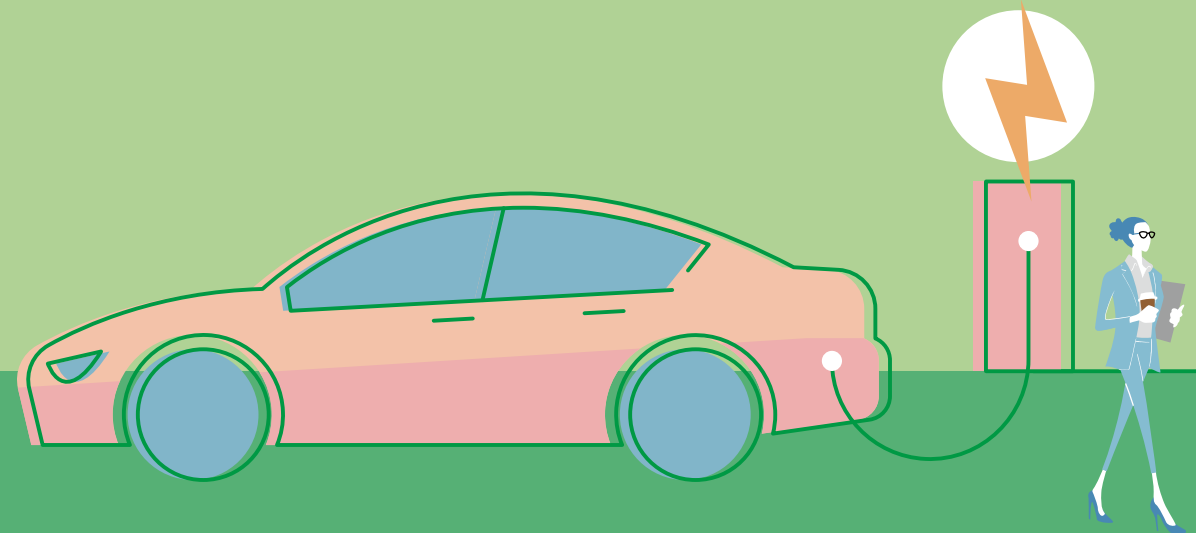
- Shopping mall
- Parking lot
- Car dealer
- Gas station
- Drug store



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

457
of
7241

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

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 repairable 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



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



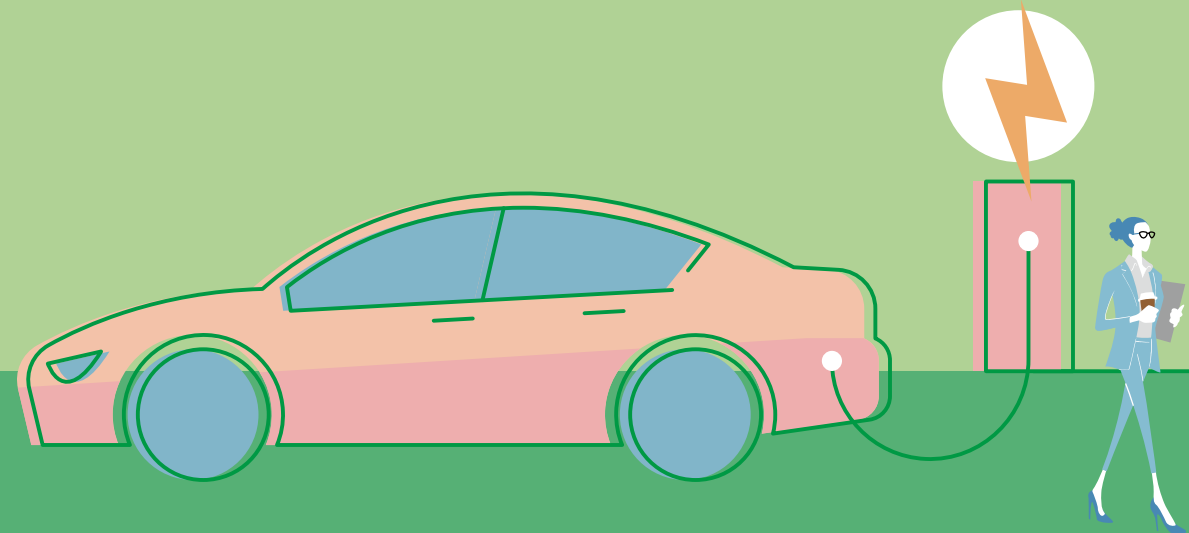
LOCALISATION >> Interoperability

Interoperability across any CHAdeMO vehicles and chargers needs to be guaranteed



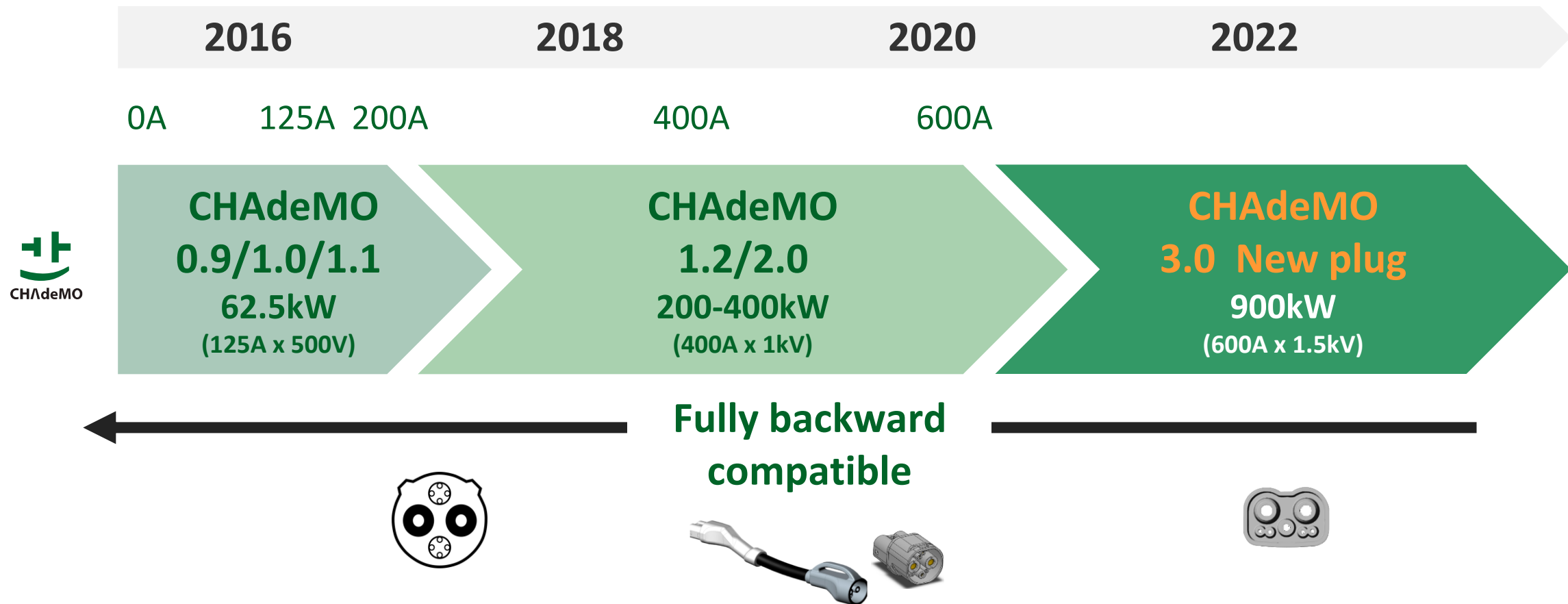
CHAdeMO ensures this through its unique certification system

INNOVATION



INNOVATION >> High Power

Standards need maintenance and evolution



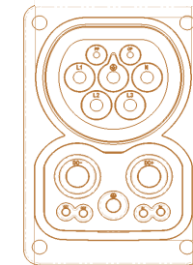
CHAdeMO evolves with full backward compatibility



INNOVATION >> ChaoJi 2/CHAdeMO 3.0

500+kW
(600A x 1kV)

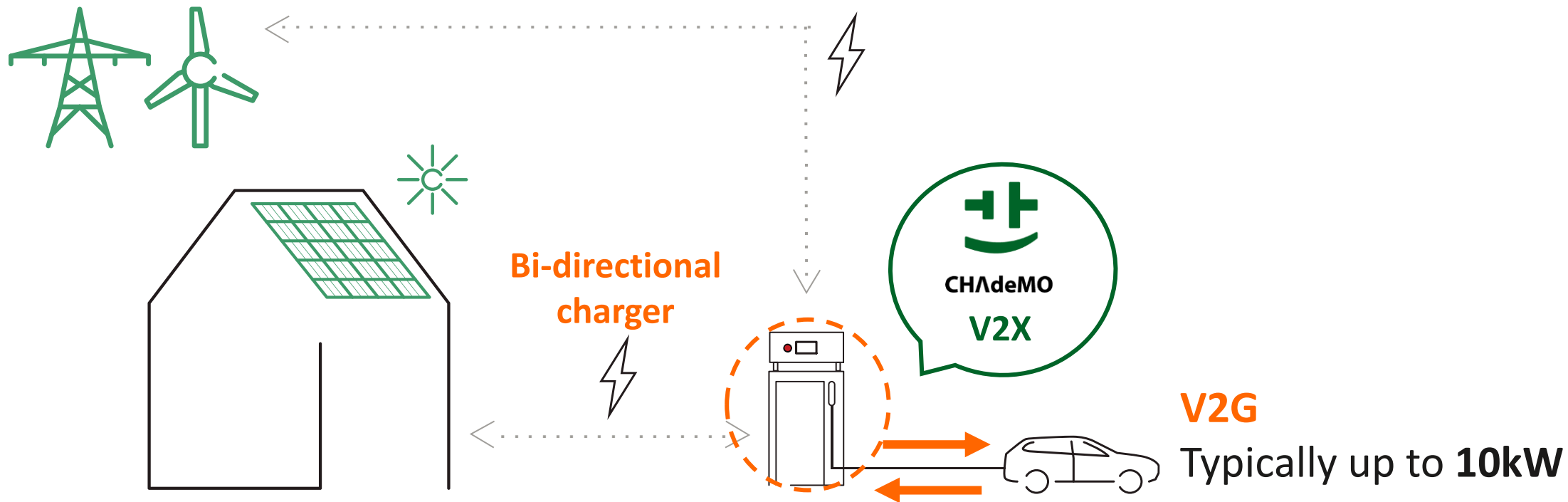
- High power charging suitable for trucks and buses
- Maximum current of 600A with liquid cooling
- Simple, light and compact connector
- Backward compatible with CHAdeMO, GB/T and CCS
- V2G and PnC ready
- Optional combo-style inlet (AC type-1, -2 and GB/T-AC)
- To be released this month



CHAdeMO 2.0 (left) vs 3.0

CHAdeMO 3.0 enables 5-minute charge for 400 km

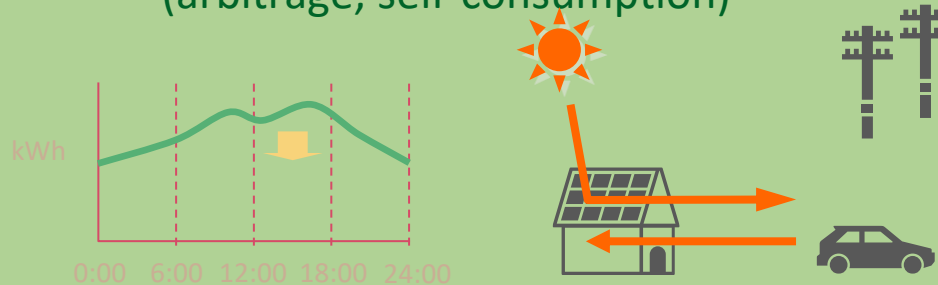
INNOVATION >> V2G



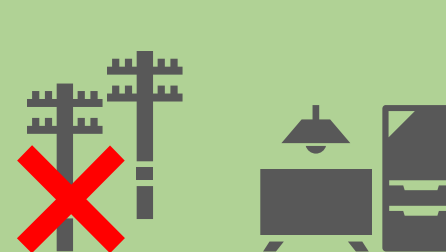
Enabler of greener grid
towards a carbon-
neutral society



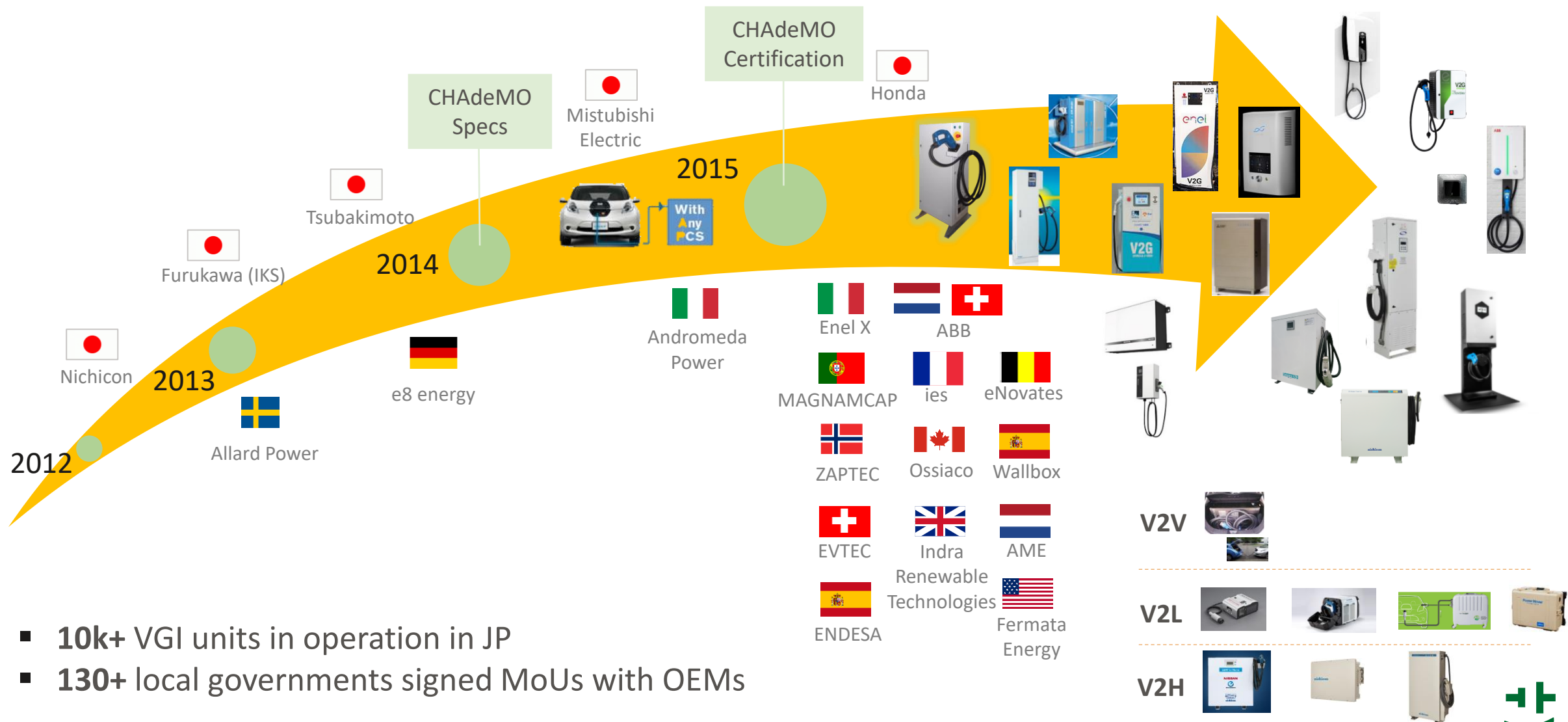
Micro-grid optimisation
(arbitrage, self-consumption)



Back-up for blackout



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



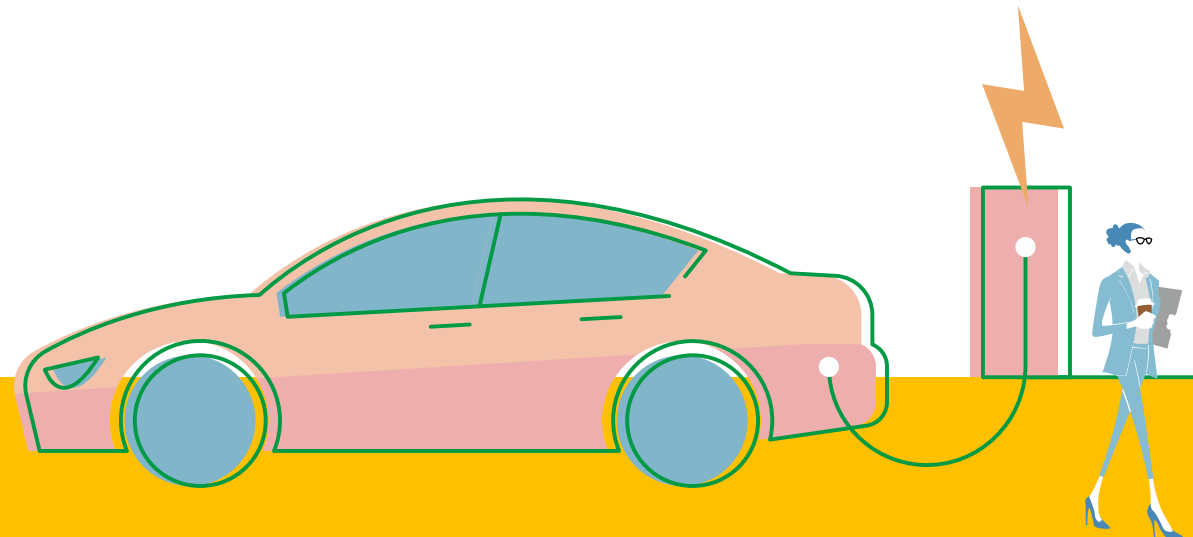
EV battery packs with PV on Amsterdam's Johan Cruyff Arena



Affordable and sustainable energy for Singapore's isolated territories

Agenda

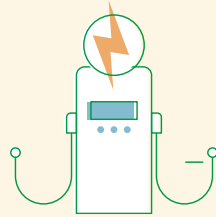
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EU charging standard case study in EU

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'

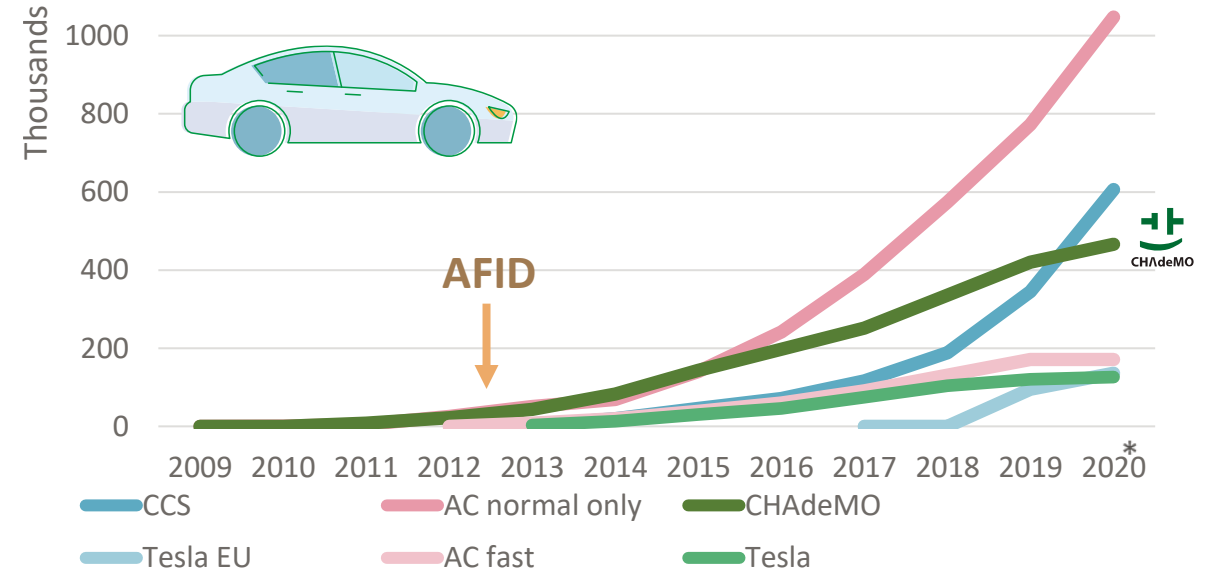


Multistandard became the *de facto* fast charging standard to serve all types of EVs

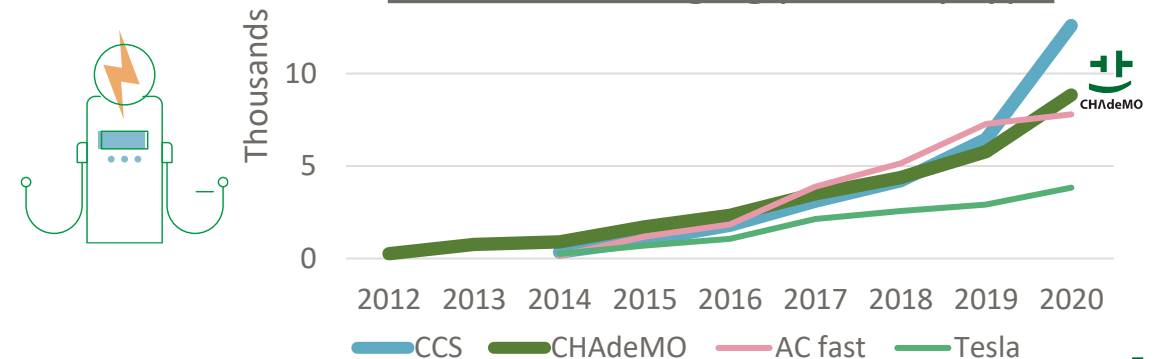
Today

- 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



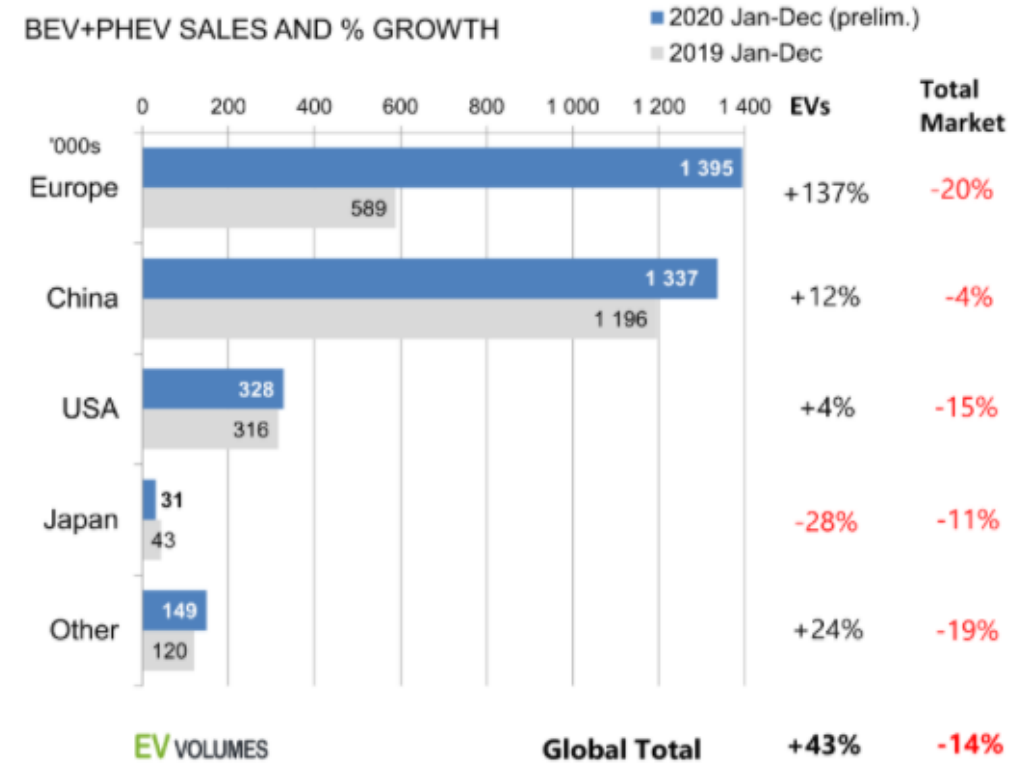
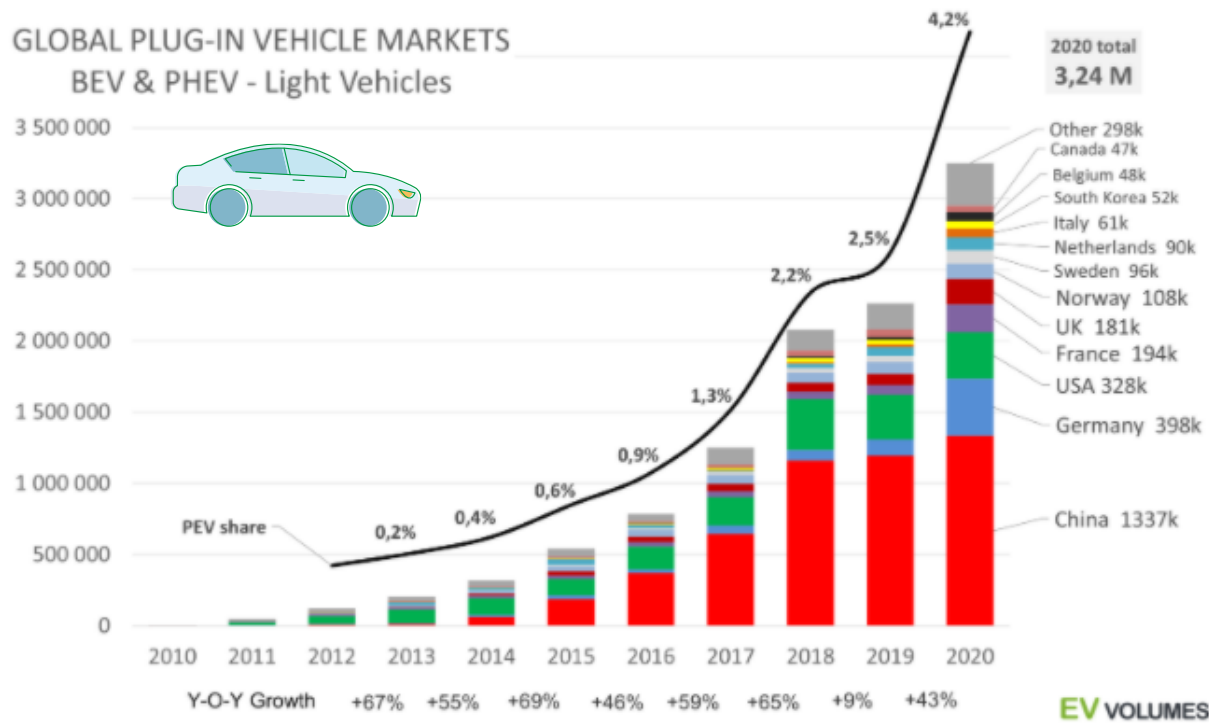
EU DC fast charging points by type



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

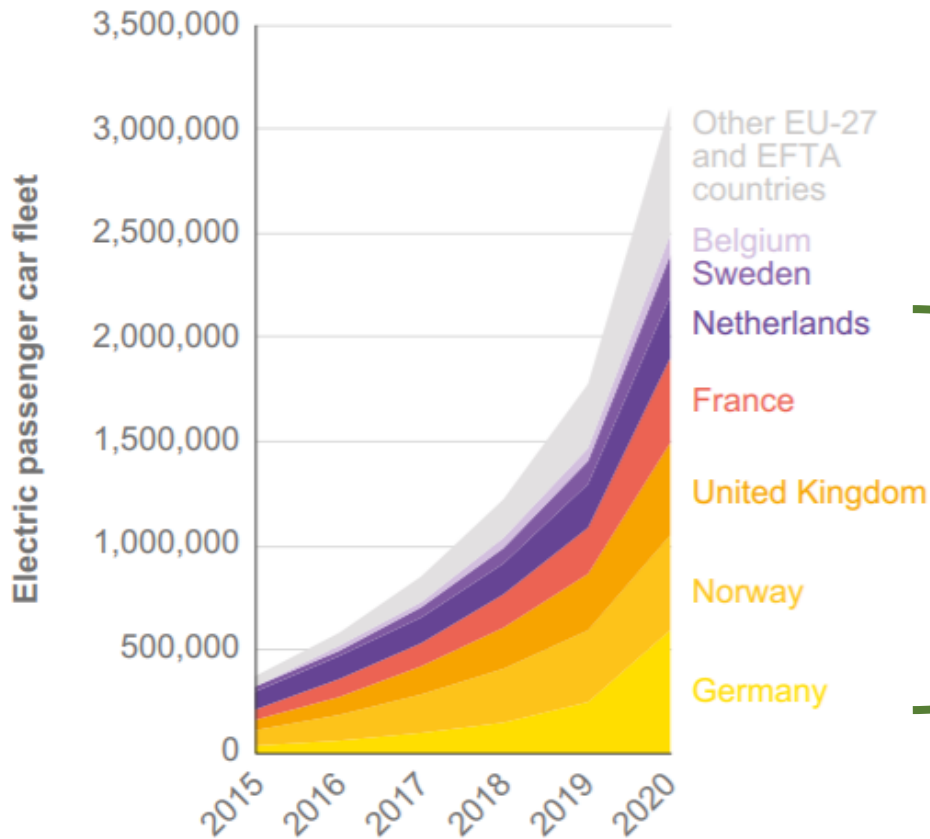
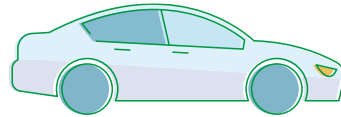


Source: EV-Volumes.com (<http://www.ev-volumes.com/news/86364/>), https://ec.europa.eu/clima/policies/transport/vehicles/cars_en

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

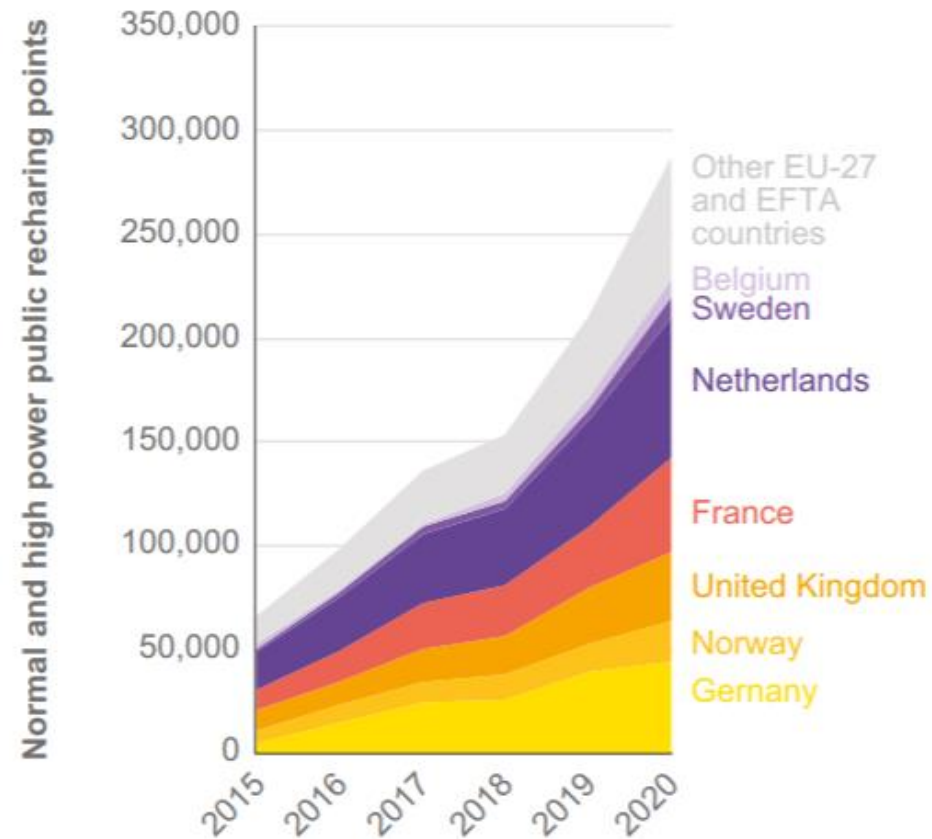
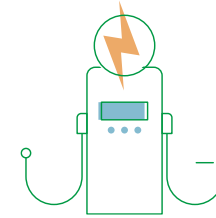
70% of EVs and 73% of public charging points in EU are found in 5 countries

Electric passenger car fleet 2020



70% of EVs

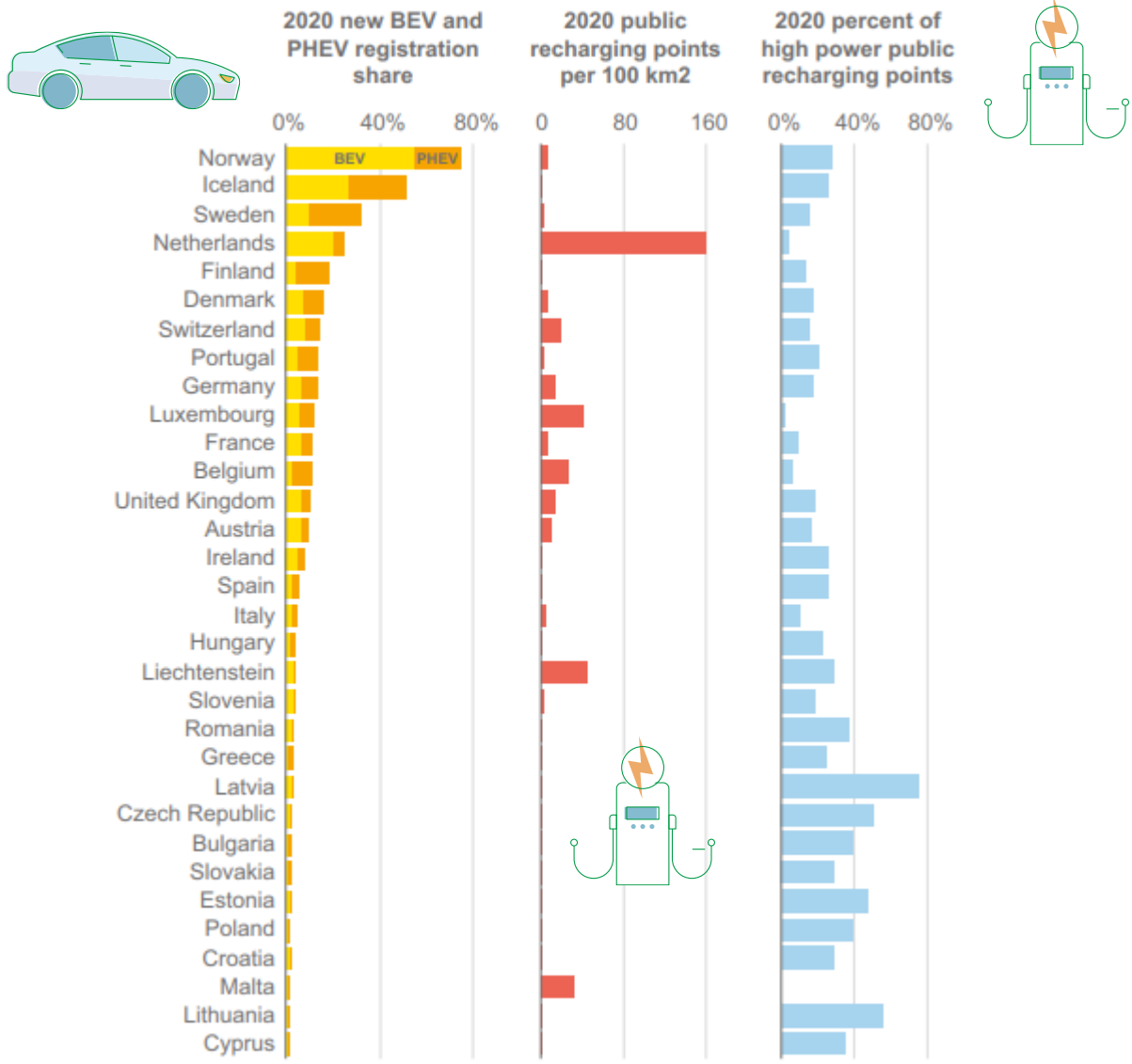
Public recharging points 2020



73% of chargers

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

... 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

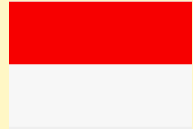
Going forward:

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)



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

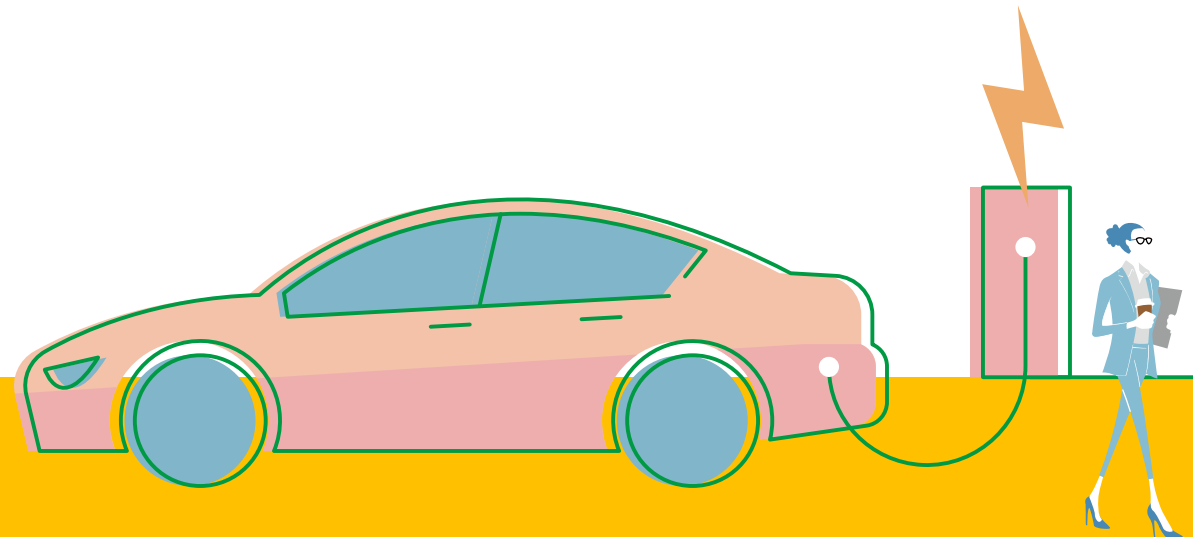
Case studies from the North America



- 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)

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- **Summary and proposals**



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



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

