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

13 April 2021

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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

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

And many, many more..
An international charging standard

<table>
<thead>
<tr>
<th></th>
<th>CHAdeMO (Global)</th>
<th>CCS 1 (US, Korea)</th>
<th>CCS 2 (EU)</th>
<th>GB/T (PRC)</th>
<th>TESLA (PROPRIETARY)</th>
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CHAdemo global charge points

TOTAL charge points: 35,600

89 countries

Europe: 16,100
North America: 6,000
Japan: 7,700
Asia: 5,100
Africa: 100
South America: 100
AU & Oceania: 500

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

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

- 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
Key factors for developing good charging infrastructure

- **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

CHAdEMO has over a decade of impeccable safety record
SUSTAINABILITY
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
### Specification Suitability

<table>
<thead>
<tr>
<th>Power, battery size, place</th>
<th>Technology envisaged</th>
<th>Application examples</th>
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<tbody>
<tr>
<td><strong>High power</strong></td>
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<td>▪ 350kW, 500kW+</td>
<td>▪ Automated charge</td>
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<td>▪ Battery 100kWh+</td>
<td>▪ New plug and/or device</td>
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<td>▪ @Dedicated base</td>
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<td>▪ @Dedicated base</td>
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<td><strong>Moderate power</strong></td>
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<td>▪ Current plugs</td>
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<td>▪ Battery 50kWh+</td>
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<td>▪ @Destination or en-route</td>
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<td>▪ Battery 50kWh+</td>
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<td>▪ @Destination or en-route</td>
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<td><strong>Low power</strong></td>
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<td>▪ Smaller plugs</td>
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<tr>
<td>▪ Battery 2-10kWh</td>
<td>▪ Wireless charging</td>
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<td>▪ @Home, depots</td>
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<tr>
<td>▪ @Home, depots</td>
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**CHAdeMO is robust and expandable for all the above**
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...

CHAdEMO is flexible and compatible with any adjacent systems (OCPP, etc.) or business models
SUSTAINABILITY >> Viable business model

Optimal location for siting charging stations

Some examples:
- Shopping mall
- Parking lot
- Car dealer
- Gas station
- Drug store

<table>
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<tr>
<th>Japan</th>
<th>USA</th>
<th>Europe (NL)</th>
<th>China</th>
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Some statistics:

- Car Dealers: 2,283
- City Office: 301
- Roadside Stn: 687
- SA·PA (Hwy): 391
- Shopping Mall: 391
- Hotels: 162
- Gas Stations: 66
- Stores: 1,032

Total of 457 out of 7241
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
**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.
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

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<tr>
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<th>2016</th>
<th>2018</th>
<th>2020</th>
<th>2022</th>
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<tbody>
<tr>
<td>Currents</td>
<td>0A</td>
<td>125A</td>
<td>400A</td>
<td>600A</td>
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</table>

- **CHAdemo 0.9/1.0/1.1**
  - 2016: 62.5 kW (125A x 500V)
- **CHAdemo 1.2/2.0**
  - 2018: 200-400 kW (400A x 1kV)
- **CHAdemo 3.0 New plug**
  - 2022: 900 kW (600A x 1.5kV)

**Fully backward compatible**

CHAdemo evolves with full backward compatibility
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 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

V2G Typically up to 10kW

Bi-directional charger

CHÀdeMO V2X

0:00 6:00 12:00 18:00 24:00 kWh

Enabler of greener grid towards a carbon-neutral society
- **10k+** VGI units in operation in JP
- **130+** local governments signed MoUs with OEMs
Innovation >> V2G

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

Great East Japan Earthquake 2011
- 66 LEAFs were temporarily provided for local government use
- Electricity recovery was faster than any other utility infrastructure

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
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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

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

... 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
... 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 facto 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

- 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