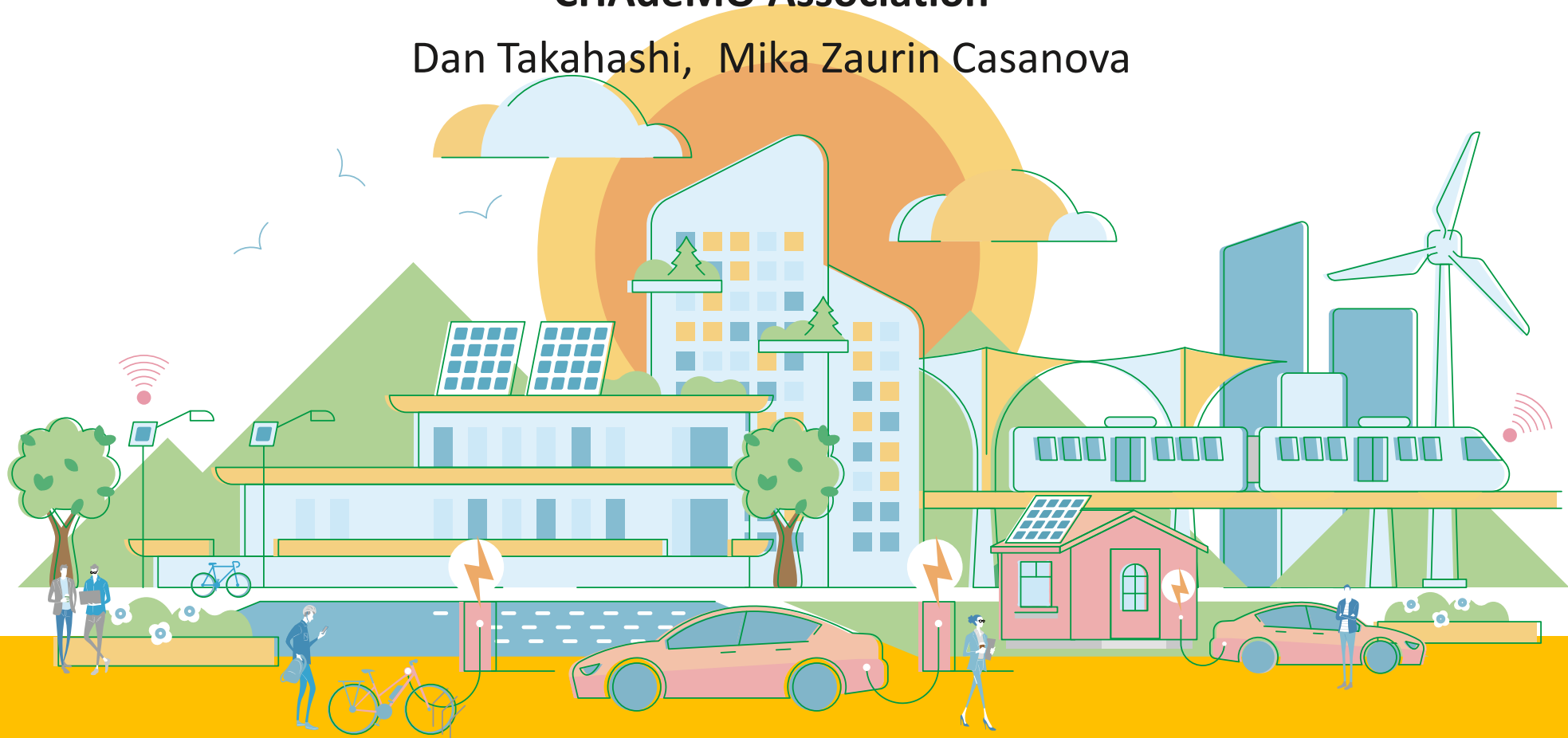


# Common Connector and Communication for EPAC Charging

15 July 2022

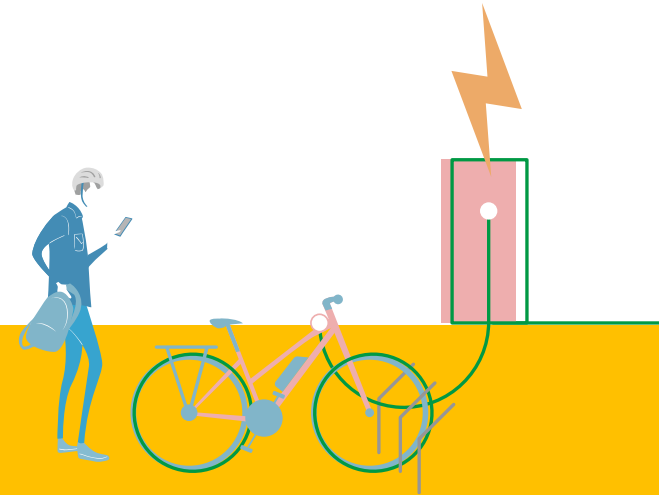
**CHAdeMO Association**

Dan Takahashi, Mika Zaurin Casanova

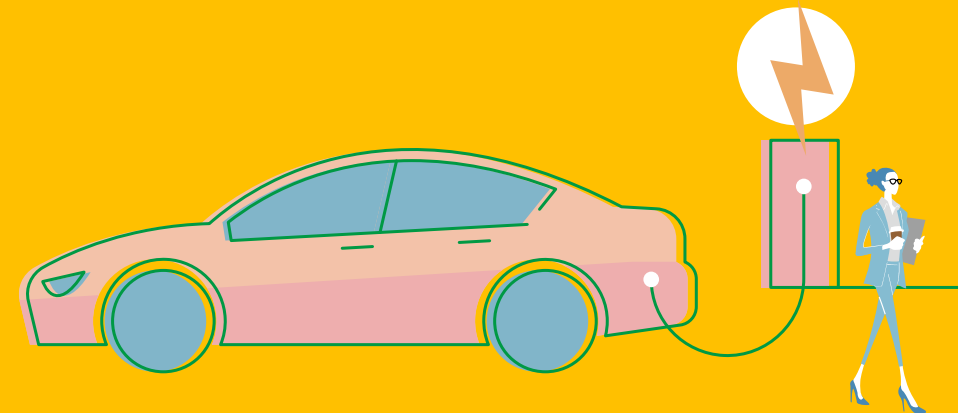
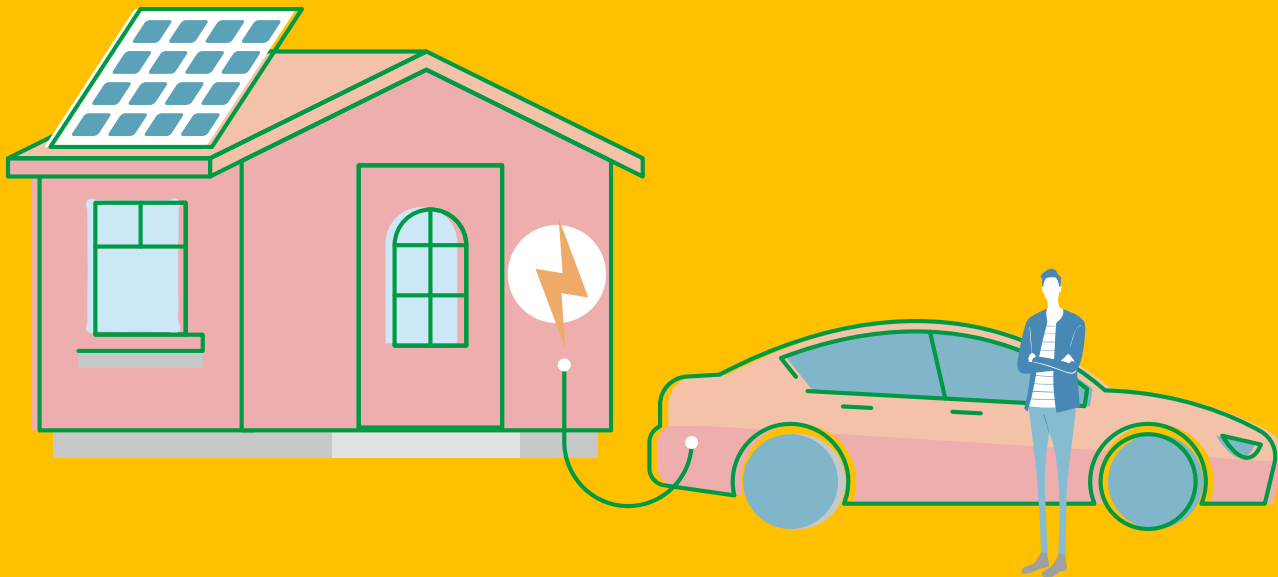


# Agenda

- I. Introduction of CHAdeMO EPAC Charger**
- II. What is CHAdeMO**
- III. Use-cases of CHAdeMO EPAC Charger**
- IV. CHAdeMO EPAC Charger Project**
- V. Membership and benefits**



# Introduction of CHAdemo EPAC Charger





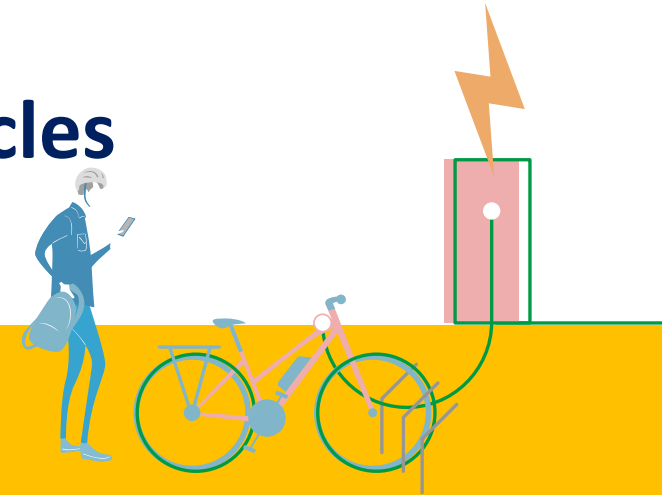
CHAdemo

# Background



**eBike market is globally growing !!**

**EPAC = Electrically Power Assisted Cycles**  
(official term in ISO standard)

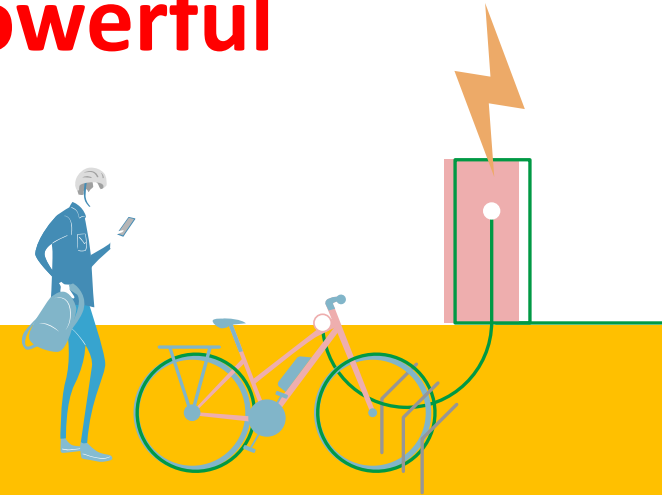




# Why do we need a new standard ?



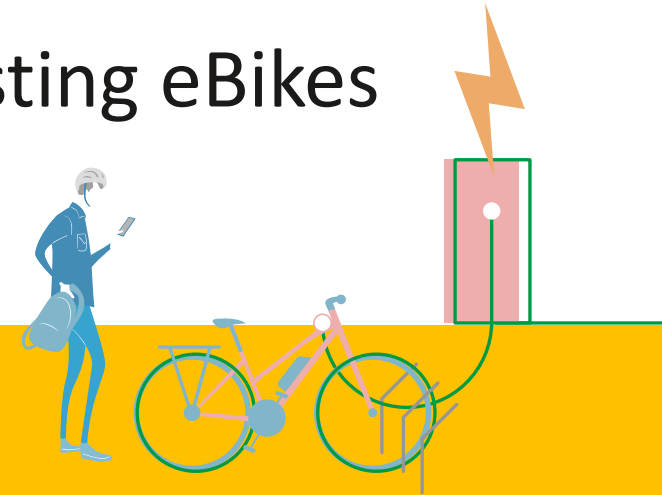
- Charging connector is **too big**
- Charging station is **too expensive**
- Charging power is **too powerful**



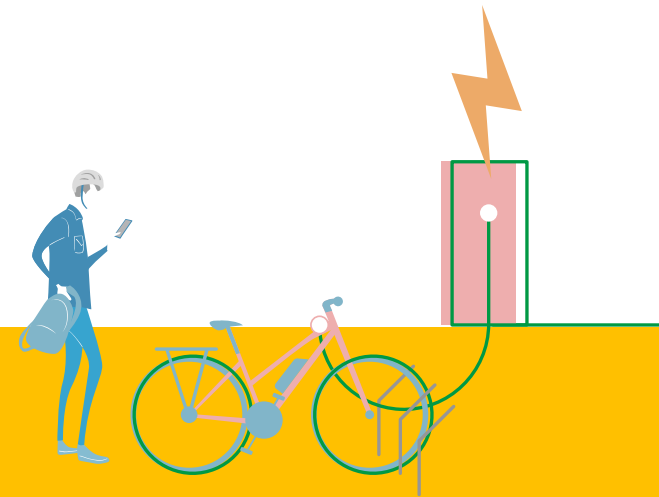
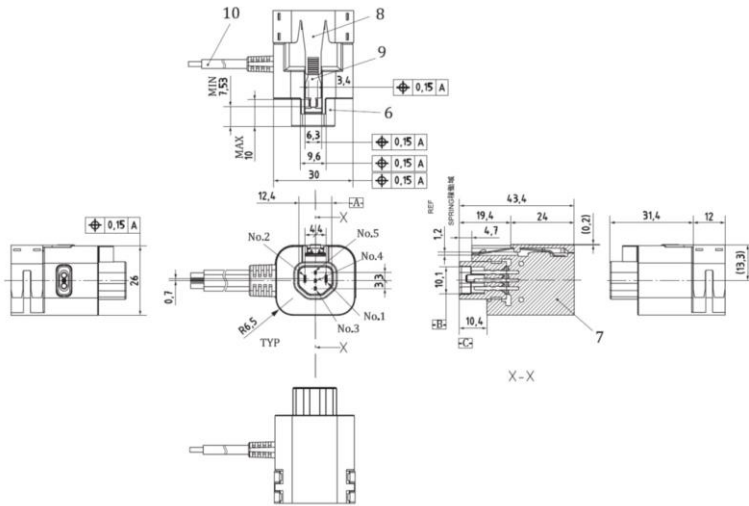
# Targets of CHAdeMO EPAC charger



- Small connector
- Simple Charging station
- Optimised power for eBikes
- Retrofit to existing eBikes



- Size**
- |         |       |
|---------|-------|
| Wide:   | 27 mm |
| Height: | 23 mm |
| Depth:  | 44mm  |

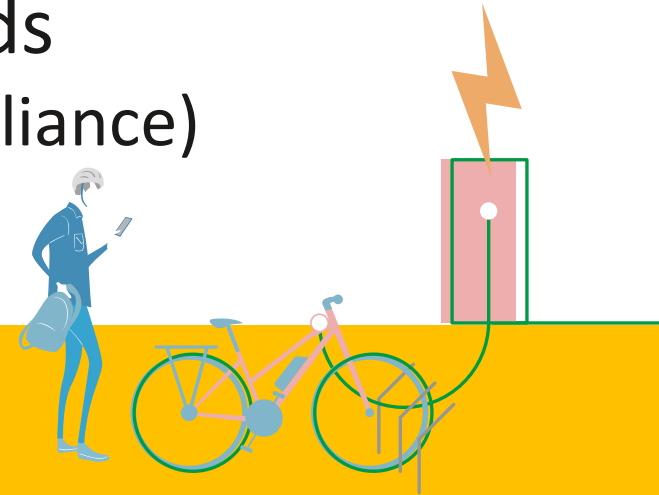




# Simple charging station



- Connect to a household outlet (AC 240V at EU countries)
- Designed for indoor & outdoor
- Comply with international safety standards (as electrical appliance)



# Optimised power for eBikes

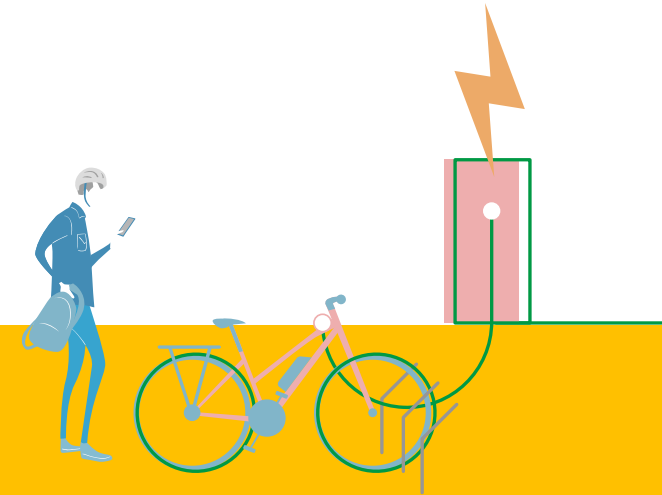


- Max 800W(=20A) output
- Designed for Li-ion battery
- Up to 36V system (nominal voltage)

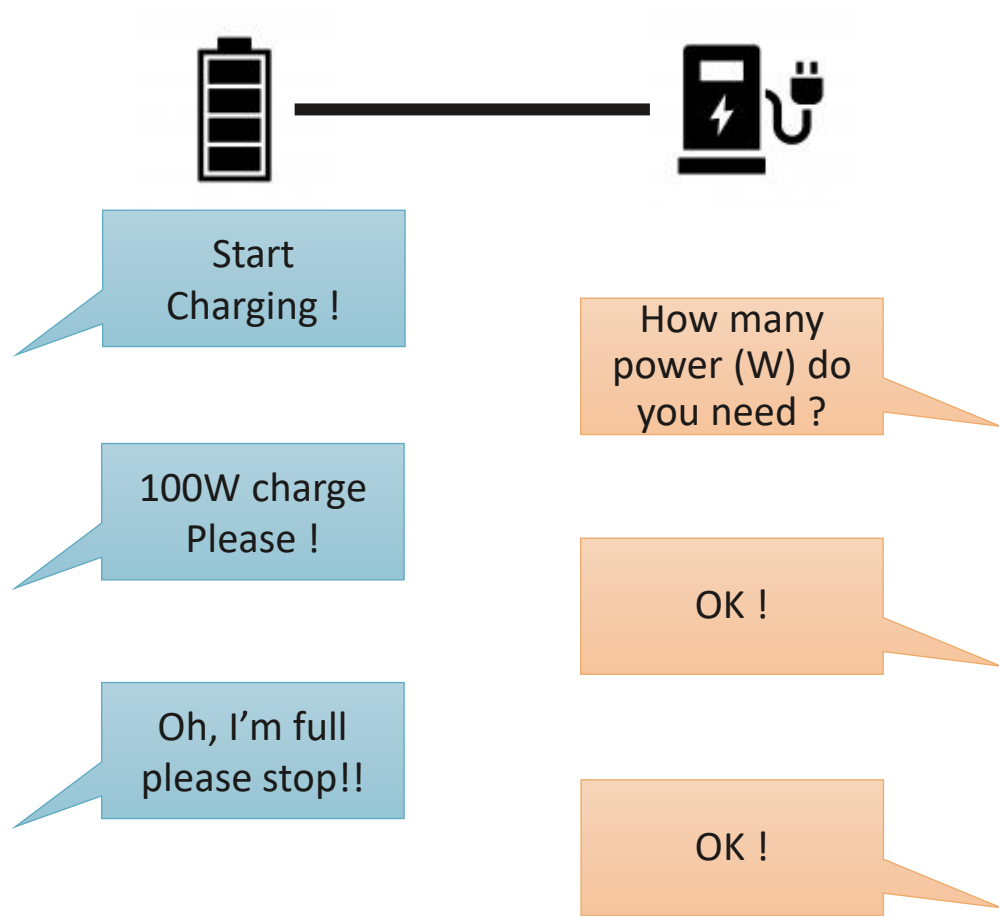


## *Use case scenario*

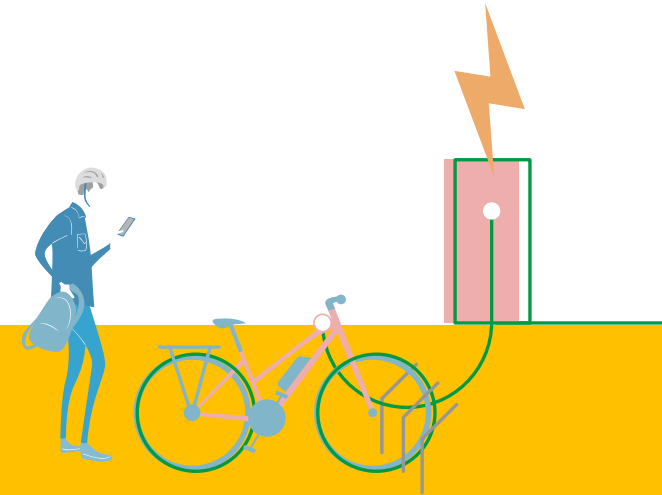
- eBike with **500Wh** Li-ion battery
- During coffee break for **30min**
- Battery is charged **70% of SOC**



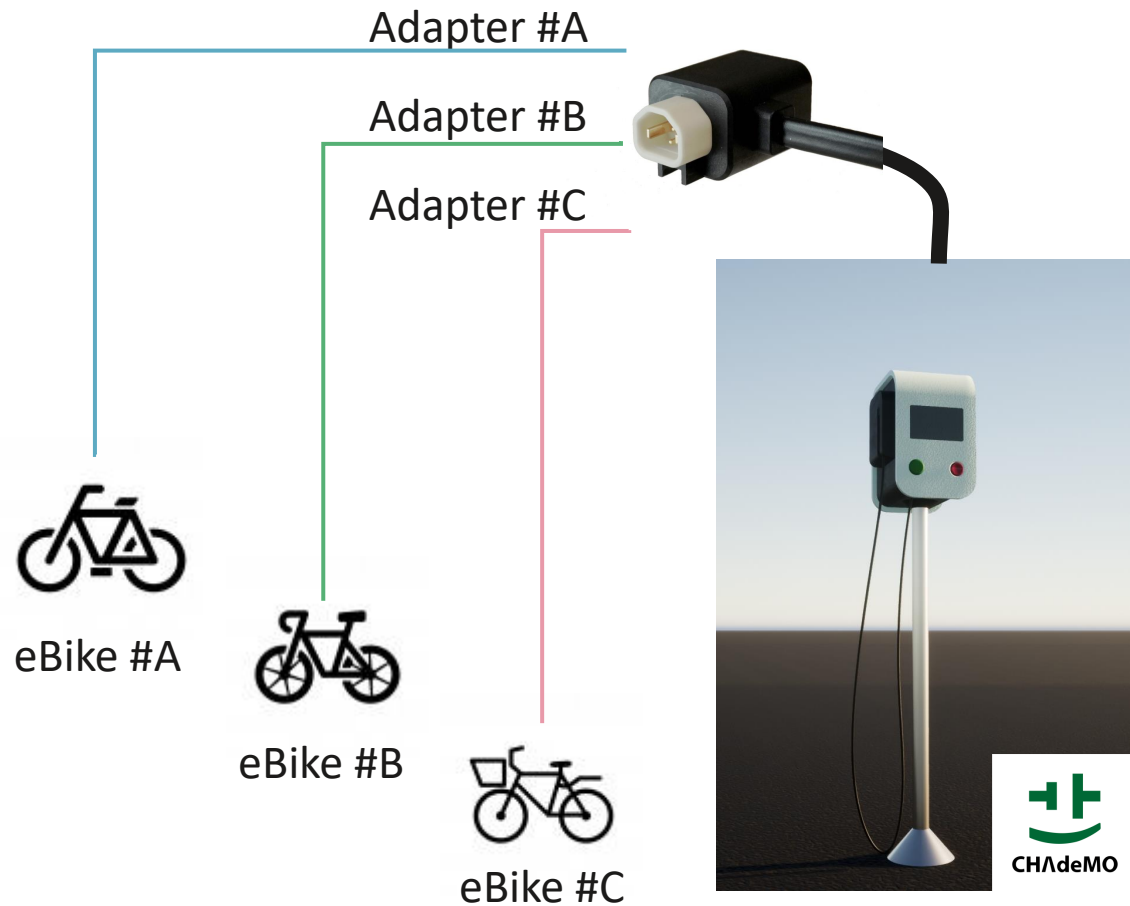
# How to control a charging process



- Charing station & eBike battery are communicate through CAN-BUS.
- Charging station is controlled under the control of eBike battery.
- CAN communication include information for safety control as well.



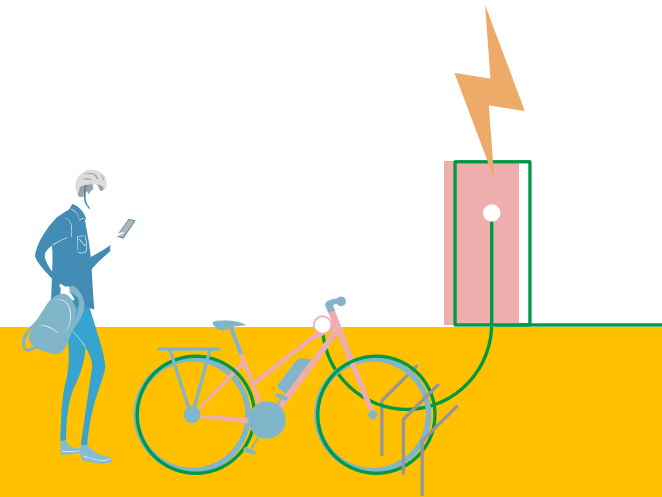
# Retrofit to existing eBikes



- Charging station is designed to work with existing eBikes.
- “Adapter” can be designed in very small size.

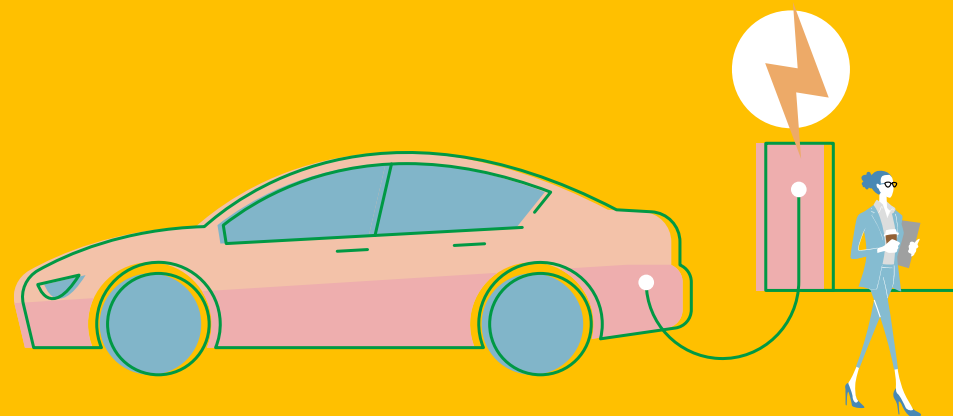
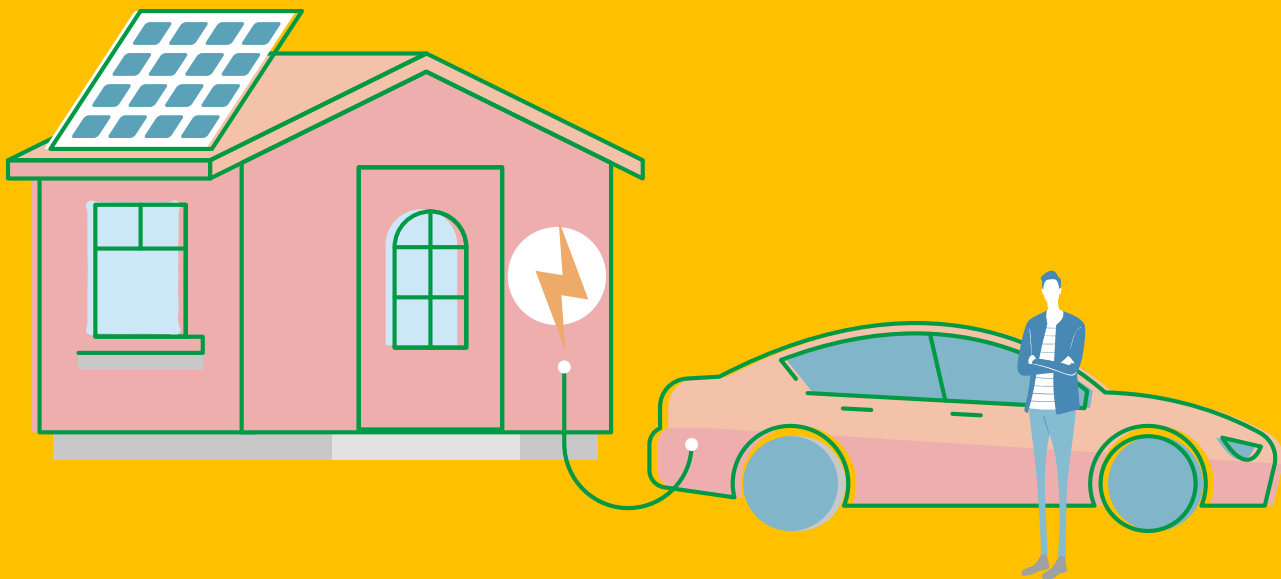


[Anker 321 USB-A to Lightning Cable \(3ft 3-in-1\)](#)



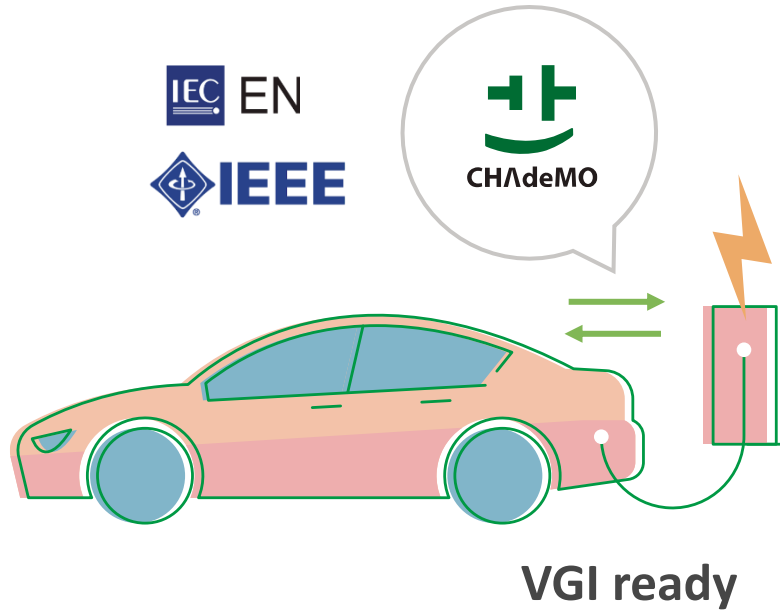


# What is CHAdemo

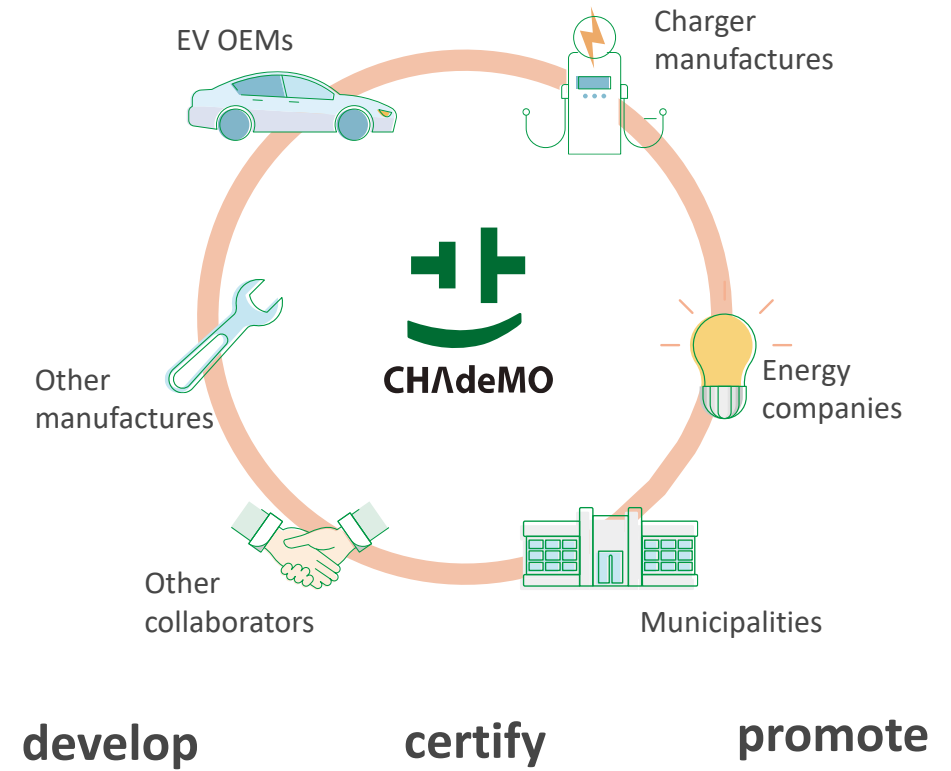


# What is CHAdeMO ?

## Charging Standard



## Organisation





# What motivates us?

## Global warming

7.6% annual cut is needed to meet the climate change targets<sup>1</sup>

## CO2 emission

Transportation is responsible for 24% of direct CO2 emissions<sup>2</sup>

## Our vision

**Powering global zero-emission mobility for the happiness of future generations**



Source: <sup>1</sup>UNEP facts about the climate emergency <sup>2</sup>IEA Tracking Transport 2020

# Our members



521

entities  
from

48

countries

165

from EU

And many, many more..

Automotive  
Manufactures

Electric (Grid) Power

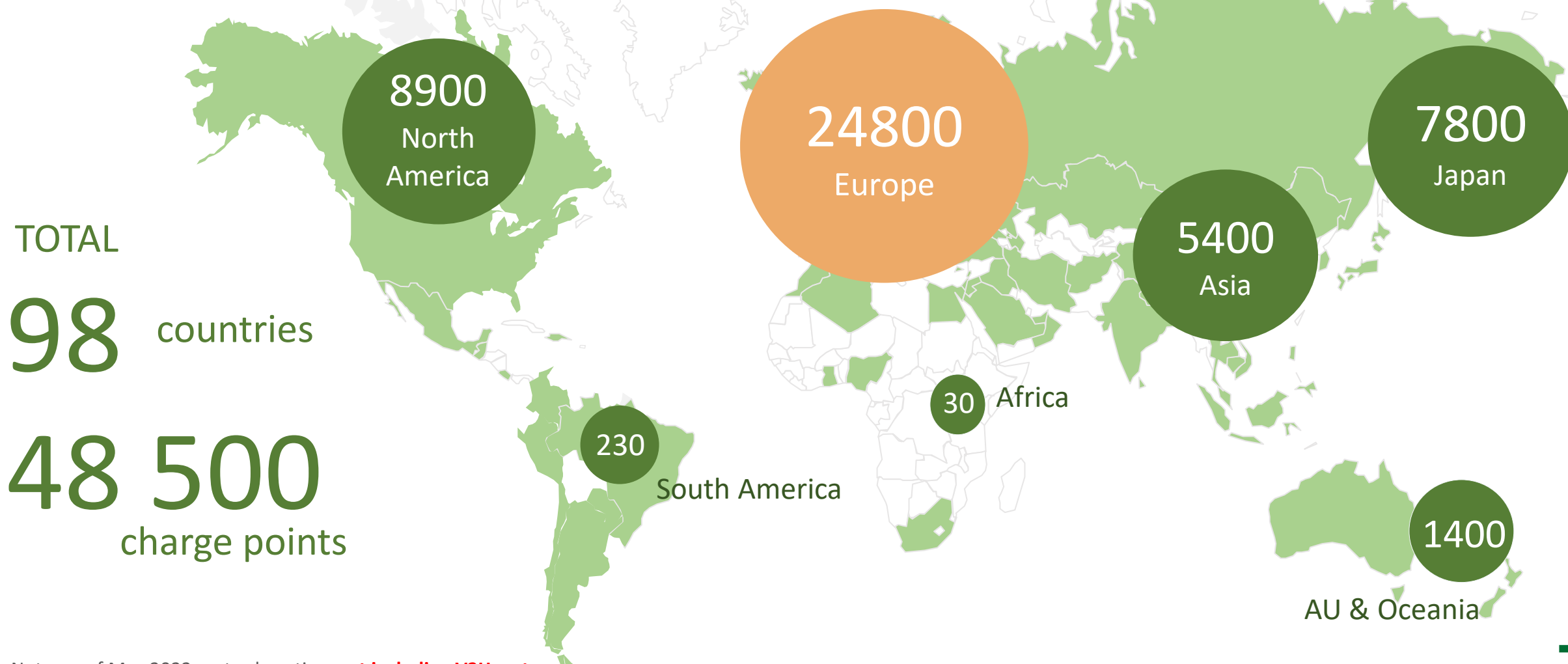
Elec. instauration &  
equipment

Test & certificate  
institutes

& others











# CHAdemo charge points



Note: as of May 2022; not exhaustive; **not including V2H systems**


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

# International charging standards

Backward Compatibility						ChaoJI
	CHAdeMO	CCS1 (US)	CCS2 (EU)	GB/T	TESLA	
Connector						
Vehicle Inlet						
 	✓	✓	✓	✓		NP proposal
						
 	✓		✓	De facto = multistandard		
 	✓	✓	✓			✓
 				✓		✓
Communication	CAN	PLC	PLC	CAN	CAN	CAN
Max spec	400kW (1kV*400A)	200kW (600V*400A)	350kW (900V*400A)	185kW (750V*250A)	-	900kW (1.5kV*600A)
Max (market)	150kW	150kW	350kW	125kW	250kW	(2022 planning)

# CHAdeMO protocol development

Over

  
**500**<sub>kW</sub>

(maximum current **600A**)

*Safe, Robust  
& flexible*



CHAdeMO 0.9



CHAdeMO 1.0



CHAdeMO 1.1



CHAdeMO 1.2



CHAdeMO 2.0



CHAdeMO 3.0

62.5kW (125A x 500V)

200-400kW(400A x 1kV)

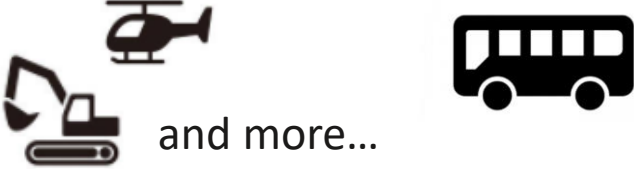

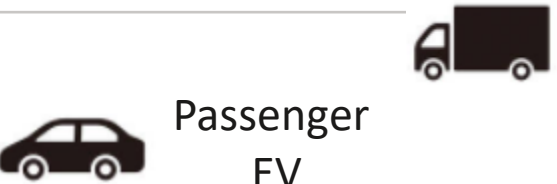

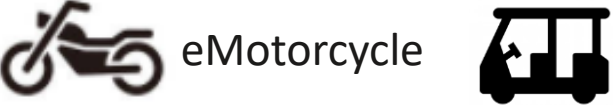



500+kW(600A x 1.5kV)

← Fully backward  
compatible →



CHAdeMO

# CHAdeMO line-up and applicable vehicle types

Application	Output Power	Specification
 and more... EV Bus	> 1 MW	 ChaoJi
 Passenger EV Commercial EV	10 to 400 kW (150V to 1,000V)	CHAdeMO (IEC 61851-23) 
 eMotorcycle LEV	1 to 10 kW (20V to 120V)	e-PTW CHAdeMO (IEC 61851-25) 
 eBike eScooter	< 800 W (max 42 V)	EPAC CHAdeMO (Based on ISO/TS 4210-10) Electrically Power Assisted Cycles 



# CHAdemo for ePTW

## Advantages of deploying shared DC public infrastructure for 2/3 wheelers:

- Fair price
- Low running cost
- Environmental friendliness

<https://olaelectric.com/hyperchargernetwork>  
<https://www.greentrans.com.tw/index.php>  
<https://en.etreego.com/>

Products are starting to come out:

Ola Electric S1 (India)



E-moving iE125 (Taiwan)

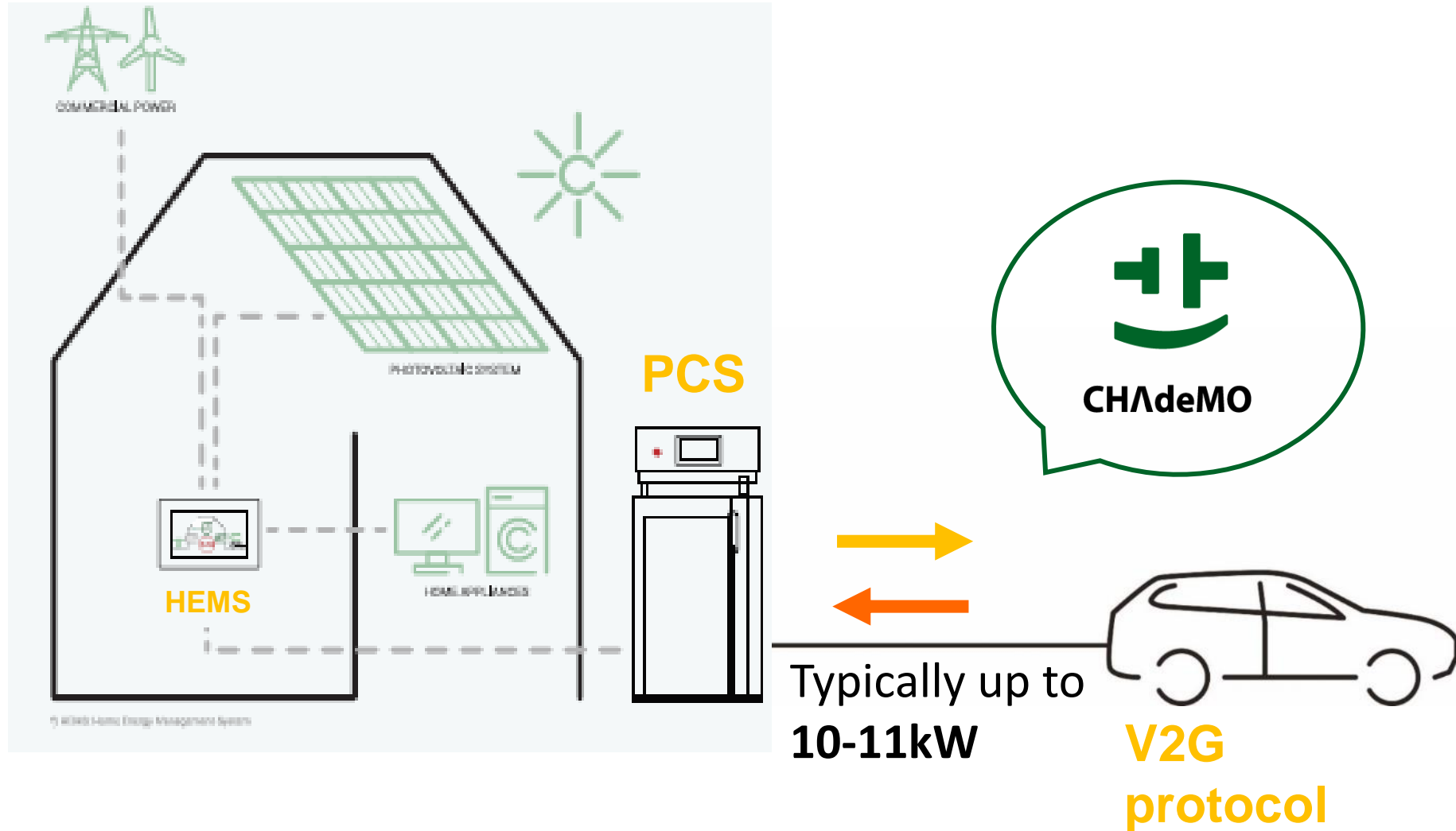


eTreego  
12kW(100A)



eTreego  
1.2kW(12A)

# V2G (vehicle-to-grid) VGI (vehicle-grid-integration)



# Examples of V2G applications



Micro-grid optimization for building or home



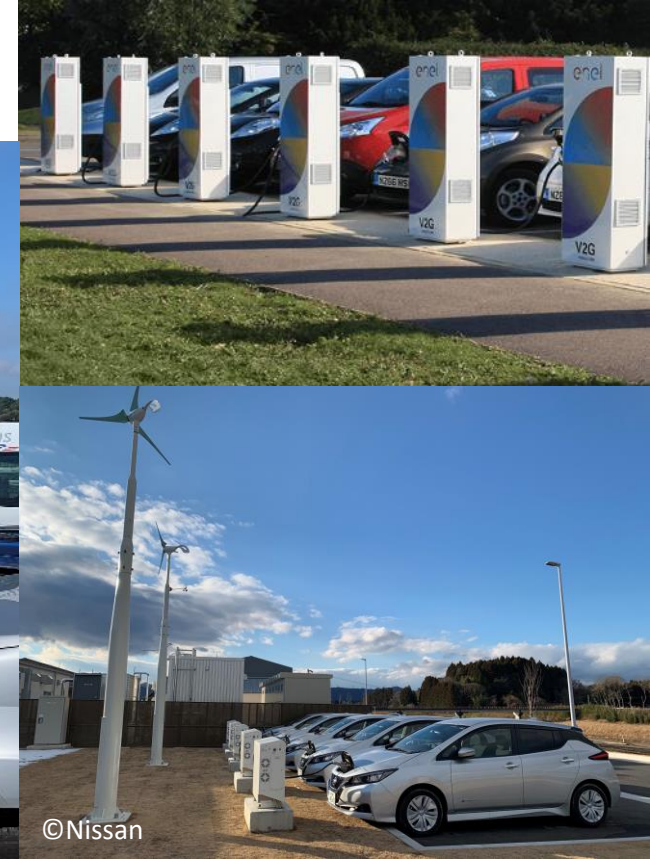
© Nissan

EV as mobile battery e.g., disaster relief



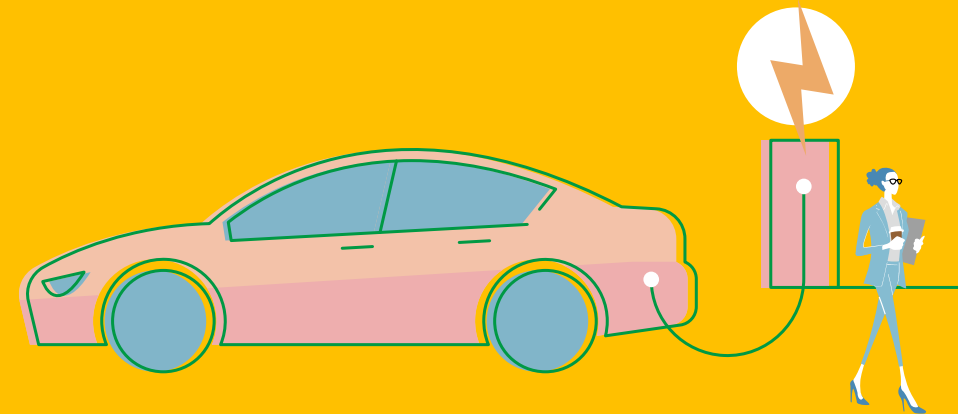
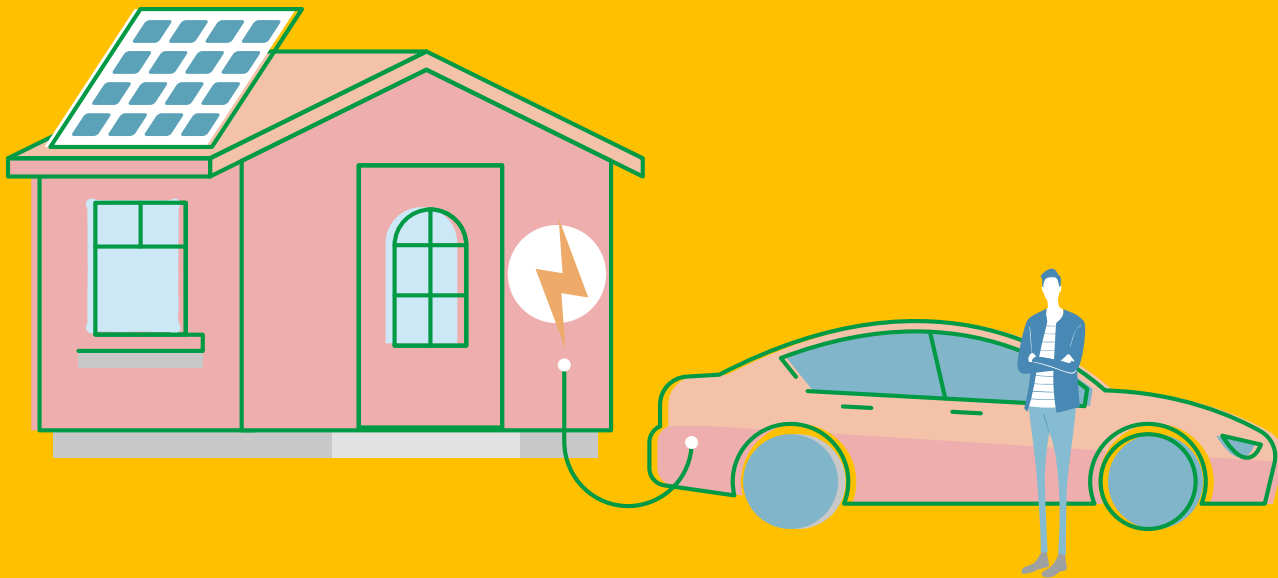
© Hitachi

Balancing the grid for to help integrate RES



© Nissan

# Use-cases of CHAdemo EPAC Charger





# Use case for single charging station

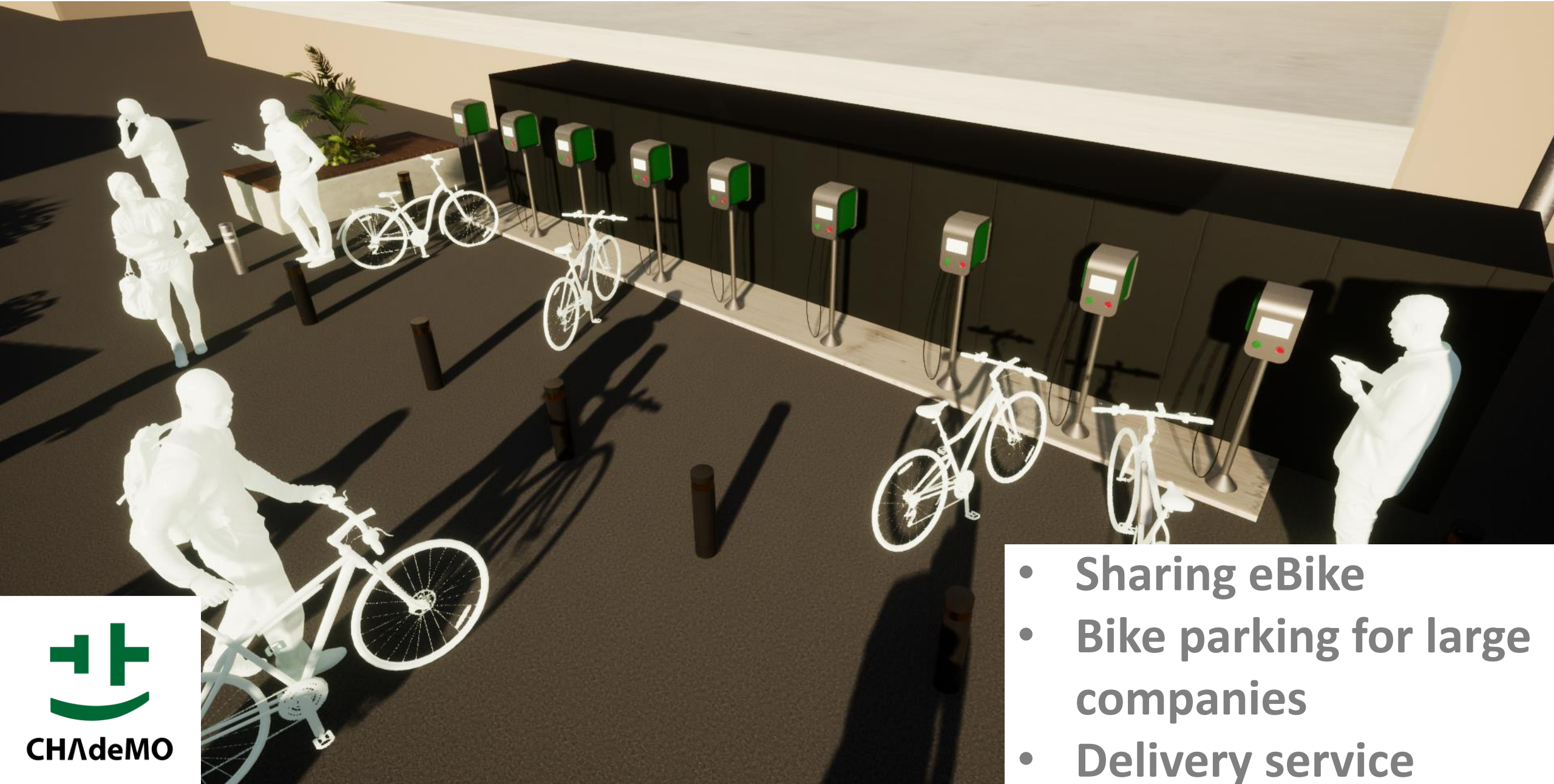


- Bicycle shops
- Cafes & Restaurants
- Private



CHAdeMO

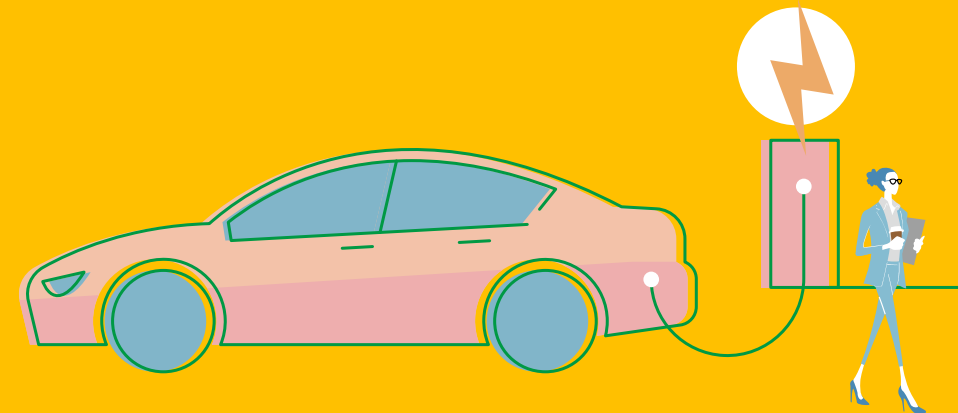
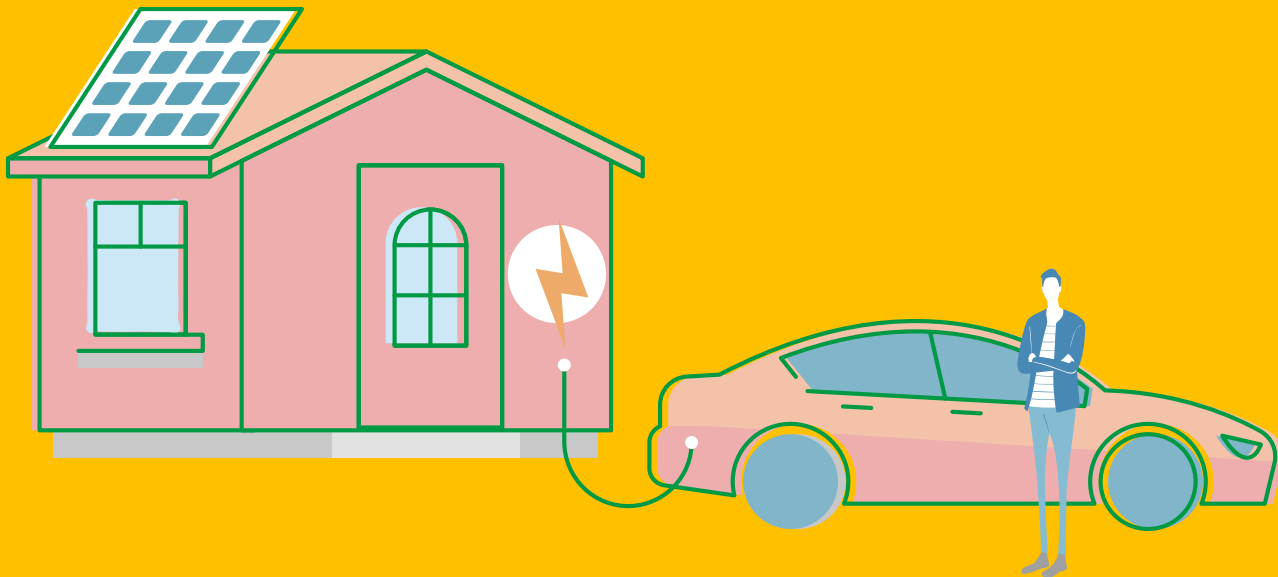
# Use case for multiple station



- Sharing eBike
- Bike parking for large companies
- Delivery service



# CHAdemo EPAC Charger Project



# Scope of CHAdeMO EPAC Charger project



Standard  
Document

- Safety requirement
- Design standard
- Communication protocol (by CAN)



Validation

- Function
- Interoperability
- Safety



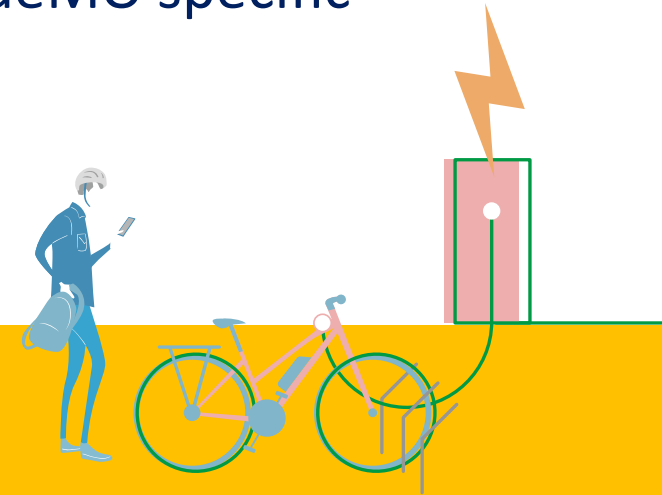
Prototyping

- Connector
- Charging station
- Adapters

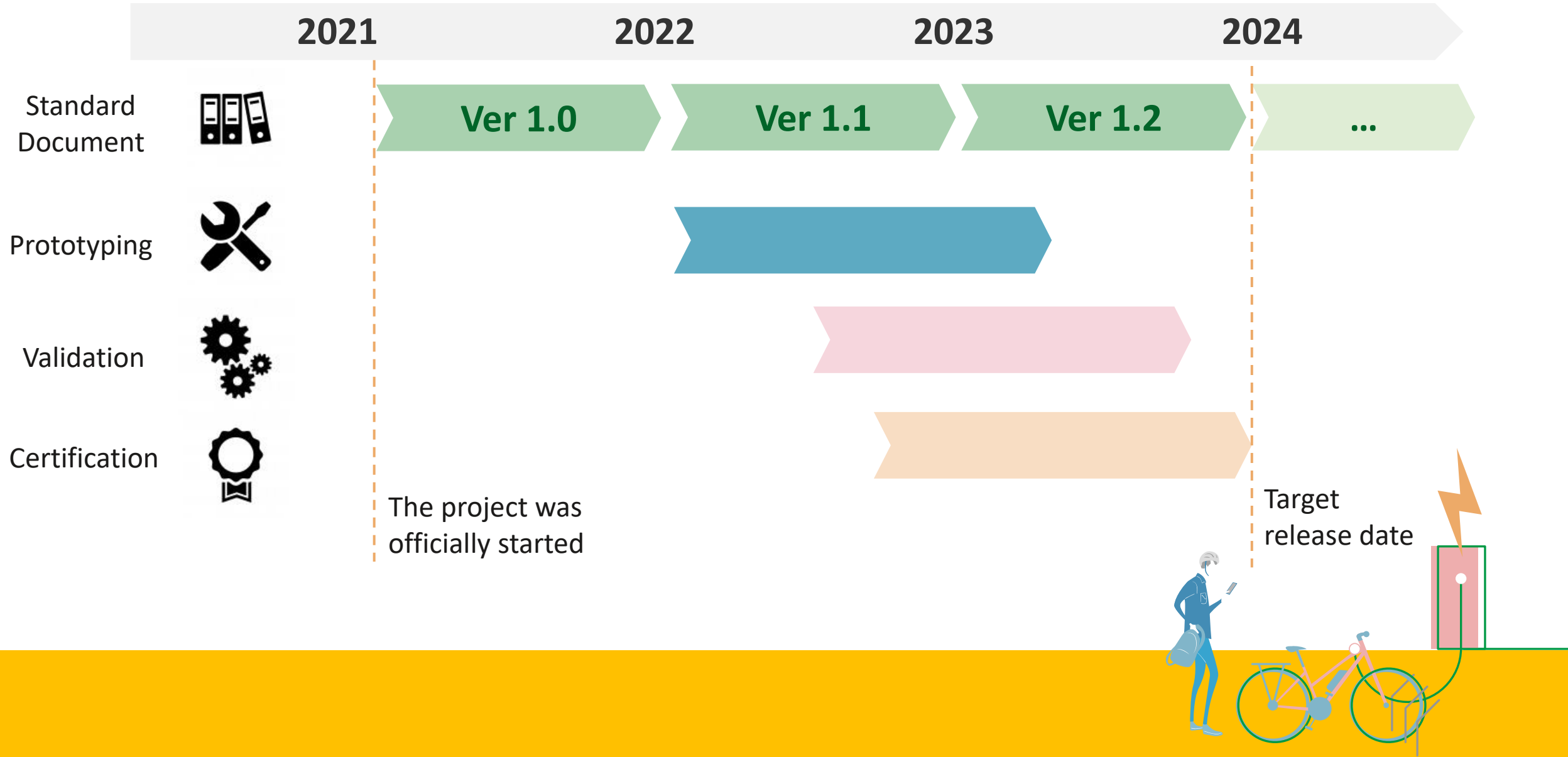


Certification

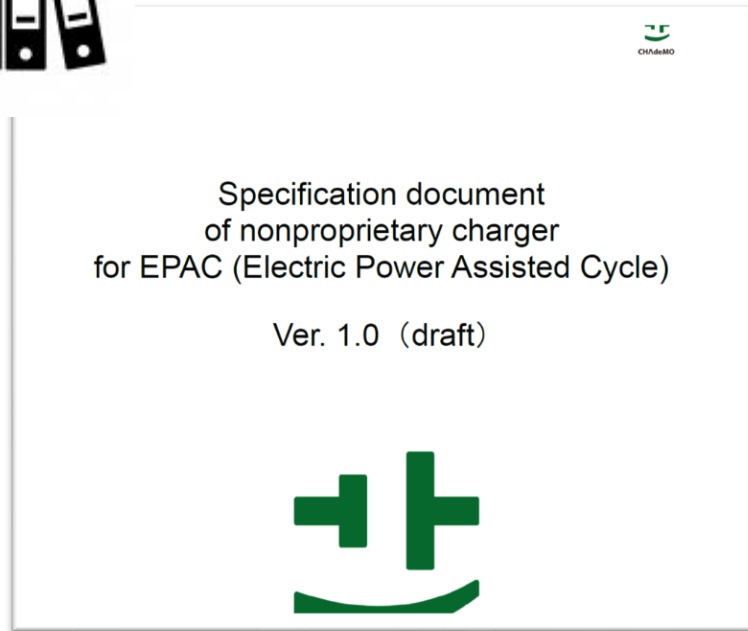
- Legal compliance
- CHAdeMO specific



# Schedule



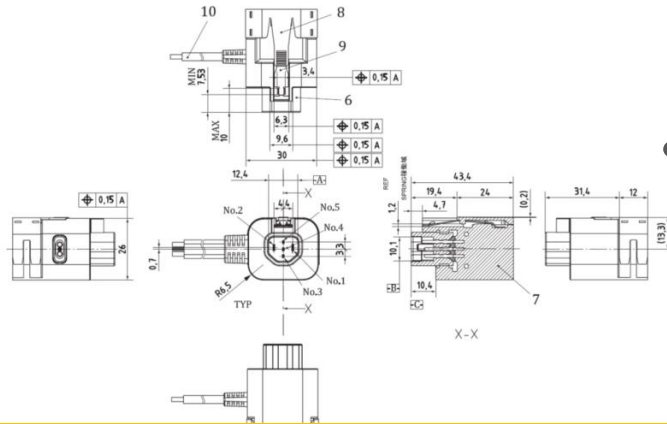
# Standard Document



Standard document development was started since 2021:

- Ver 1.0 was released on March/2022
- Will be continuously revised with the project progress
- The standard document consists from
  - i. Specification
  - ii. Protocol check sheet
  - iii. Function testing criteria

**Standard document is the center of project**



- **Connector** is finished
- **Charging station** is on-going
- **Communication protocol (software)** in-between charging station & eBike battery is on-going with eBike system suppliers
- A prototype will be used to evaluate functionality and interoperability.



# Validation

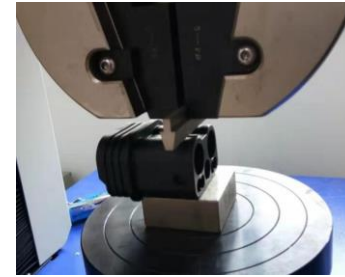
**Validation is the key to ensure safety** from various hazards:

- **Thermal hazard**
  - ✓ *Electric cable heat-up due to high current*
- **Electrical hazard**
  - ✓ *high voltage electrical shock*
- **Mechanical hazard**

Examples for mechanical safety tests  
From CHAdeMO EV charger



Runover test



Crushing test



Drop test



Impact-ball test

**CHAdeMO has over 10 years experience to ensure safety**



# Certification

- 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

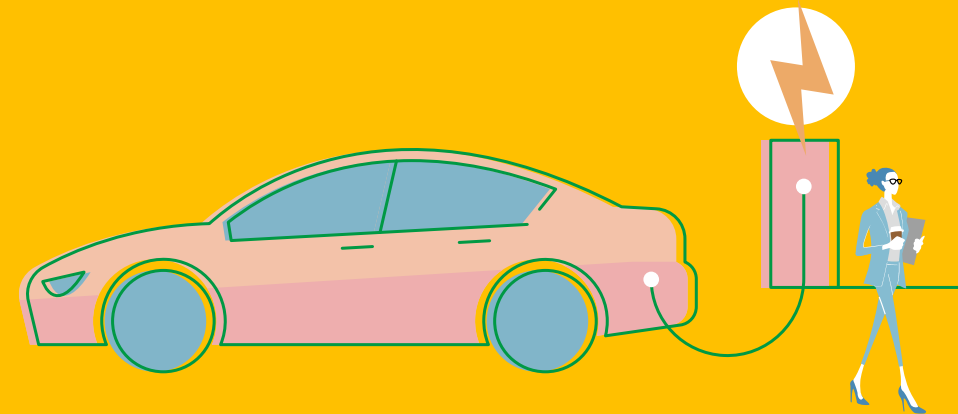
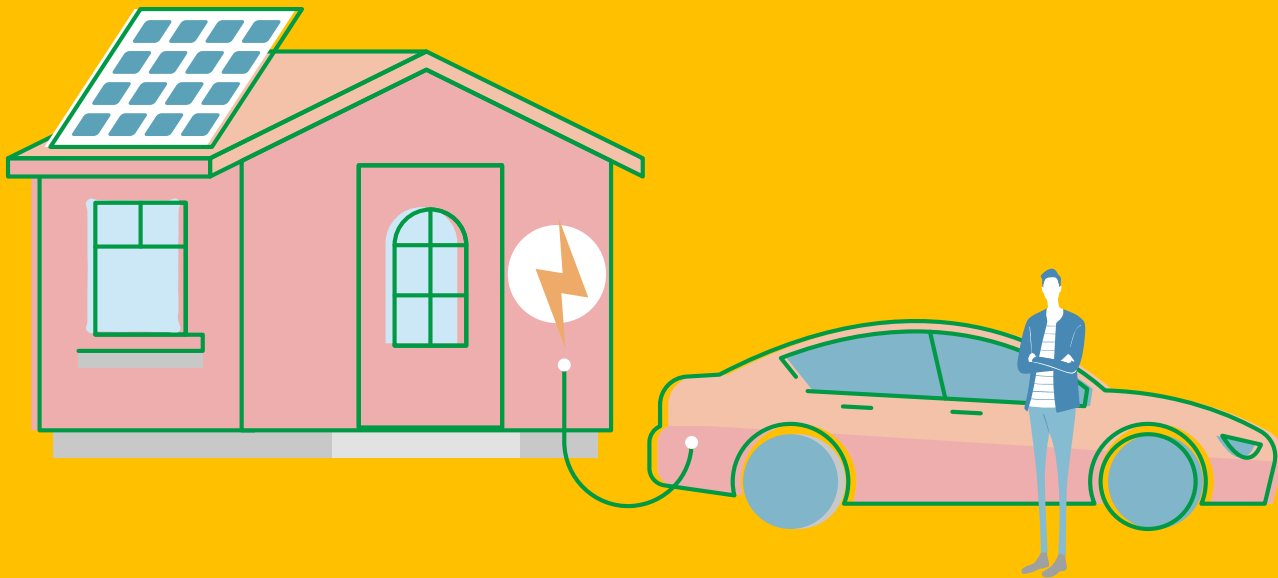


**Independent certification body is important**

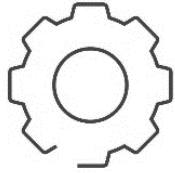


**CHAdeMO has installed a global certification network**

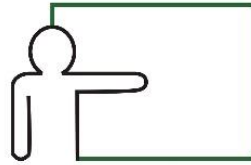
# Membership and benefits



# Benefits of becoming a CHAdeMO member



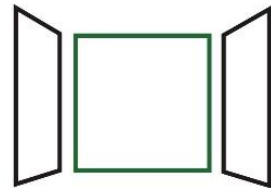
Access to the **full technical specifications** including CAN communication



**Networking opportunities** through member only workshops, meetings and conferences



**PR opportunities** through CHAdeMO newsletters, website, workshops and social media



**Get global visibility** through the participation in CHAdeMO exhibition stand at major trade fairs



CHAdeMO

**Authorized use of CHAdeMO logo** on your corporate materials, website, and CHAdeMO-related products



CHAdeMO

# CHAdemo Membership

	REGULAR	SUPPORTING	SPECIAL
Annual member fee*	¥500 000   €4000	¥100 000   €800	¥0   €0
Benefits			
Protocol access	✓		
Tech WGs participation	✓		
Product certification	✓		
CHAdemo exhibition booth participation	✓	✓	
Marketing opportunity	✓	✓	✓
Participation in member meetings	✓	✓	✓
Association's newsletter	✓	✓	✓

# Thank you

**For more information:**

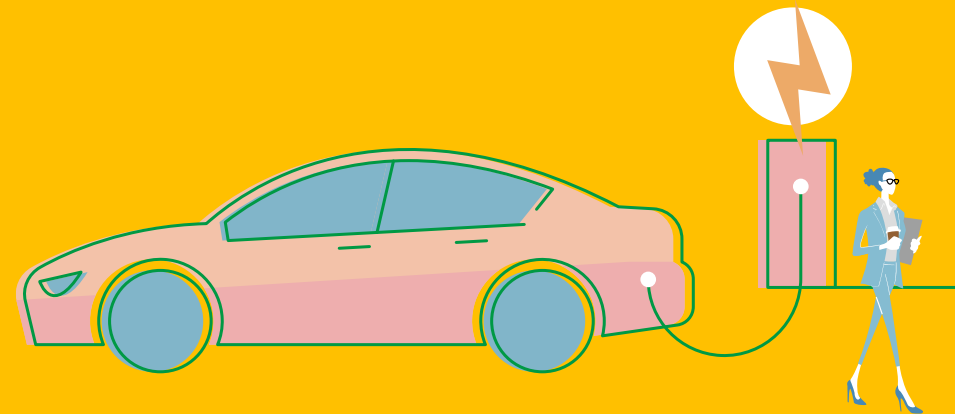
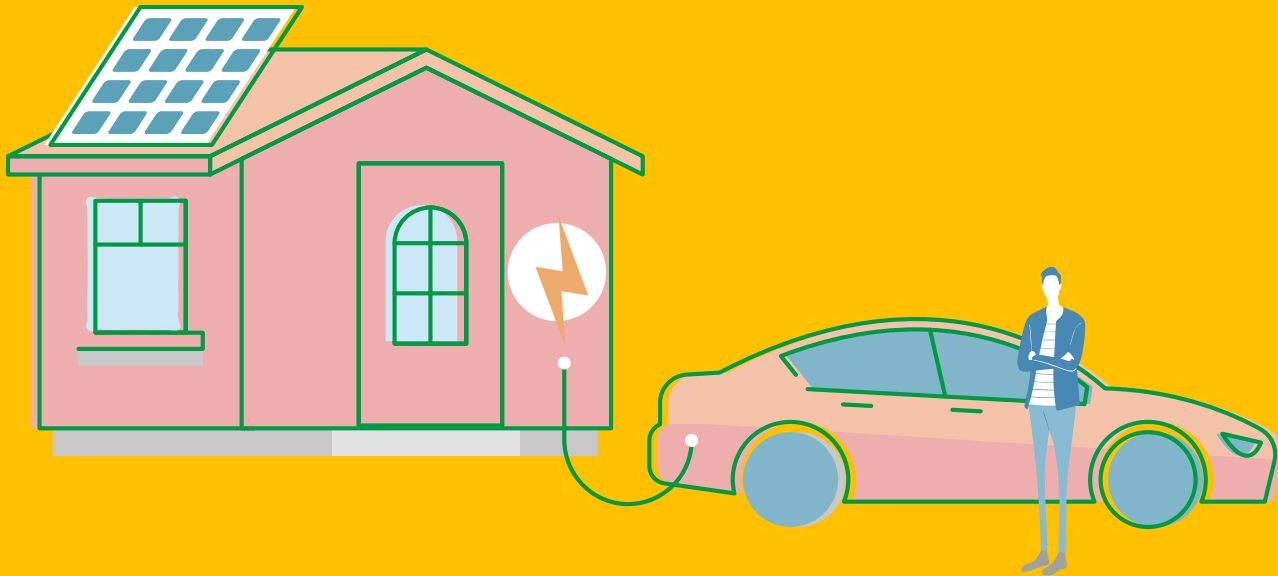


[www.chademo.com](http://www.chademo.com)



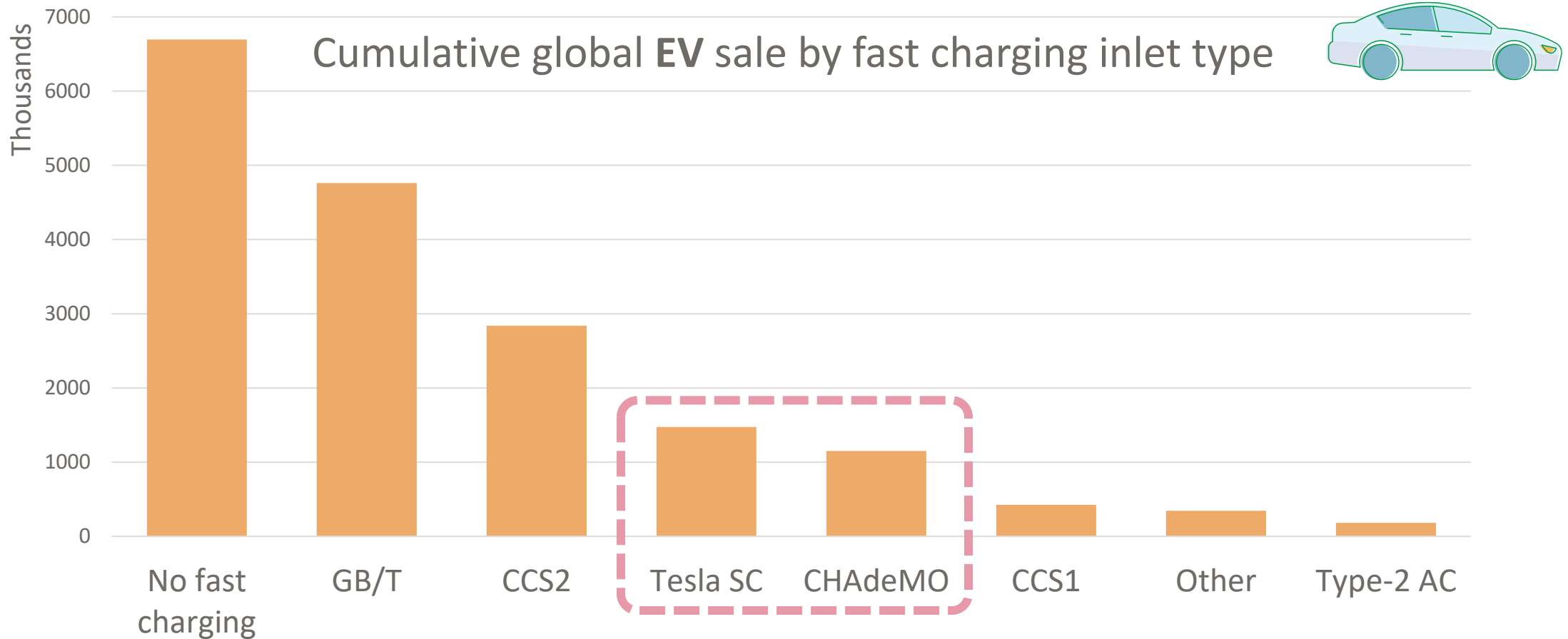
[info@chademo.org](mailto:info@chademo.org)

# Back-ups





# CHAdemo chargers for 2.6M EVs in the world



Source: EV-volumes.com; as of end 2021

\*CCS1 and CCS2 have different inlet shapes; exact breakdown is unknown to us, but here we assume the Americas = CCS1, and Europe, Africa & ME = CCS2, prorating the Asia Pacific sale (75k) between the two

\*\*Other includes unspecified, unknown, optional, BYD

# INNOVATION >> ChaoJi

- High Power  
900kW (1,500V × 600A)



380V×600A×10min = 38kWh  
(Estimate Range : 200~300km)

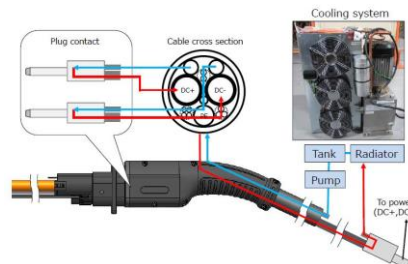
- Compact Connector



- Backward Compatibility with All Existing Standard



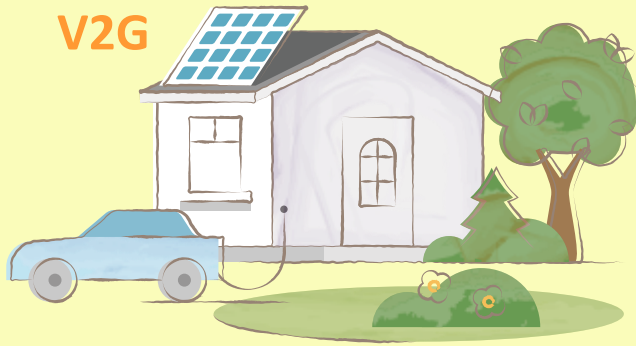
- Best Safety Level



CHAdeMO keeps its innovation

# All possible with CHAdeMO

## OFFICE/HOME CHARGING



## PATHWAY CHARGING



## DESTINATION CHARGING



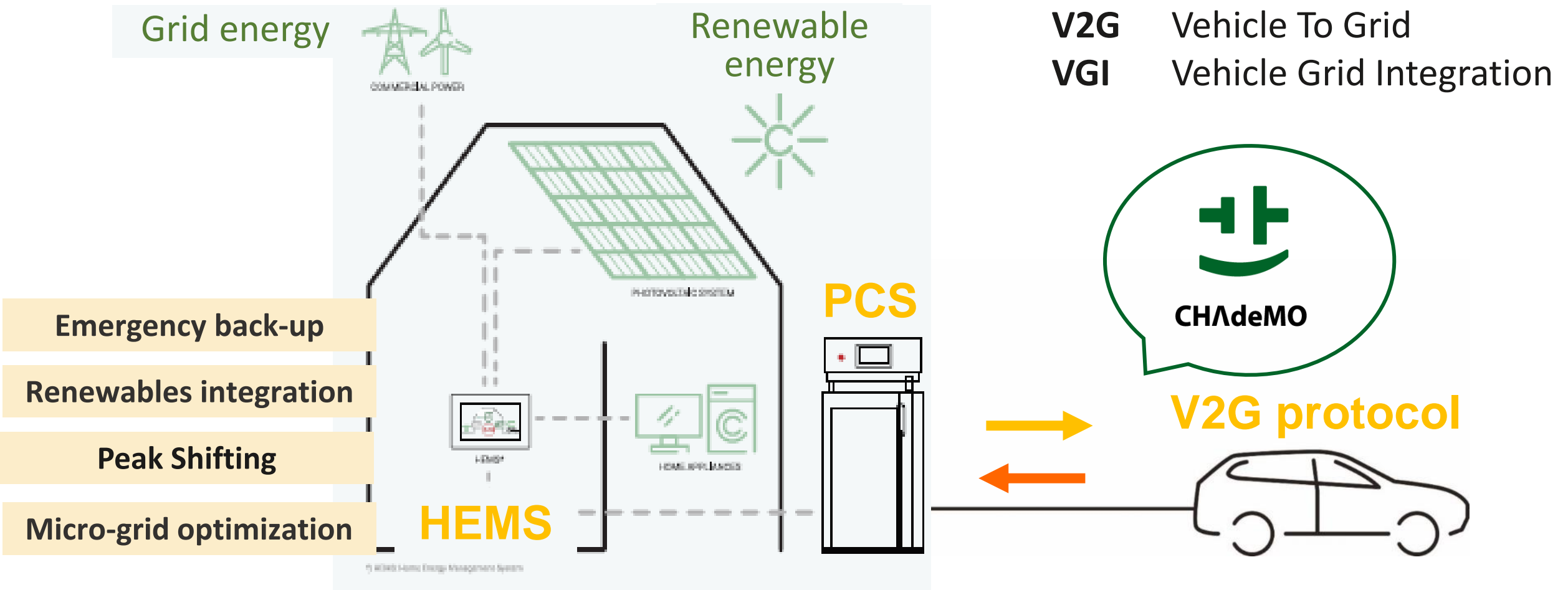
## Vehicles of all size



## Billing Authentication PnC



# INNOVATION >> V2G/VGI



**CHAdeMO is only the enabler of V2G solution**

# CHAdEMO organisation and EU steering committee

