



# Empowering the next level of e-mobility

CharIN – Charging Interface Initiative e. V.

September 15th 2022



# General Goal: The CO<sub>2</sub> neutral Mobility



## CHARIN

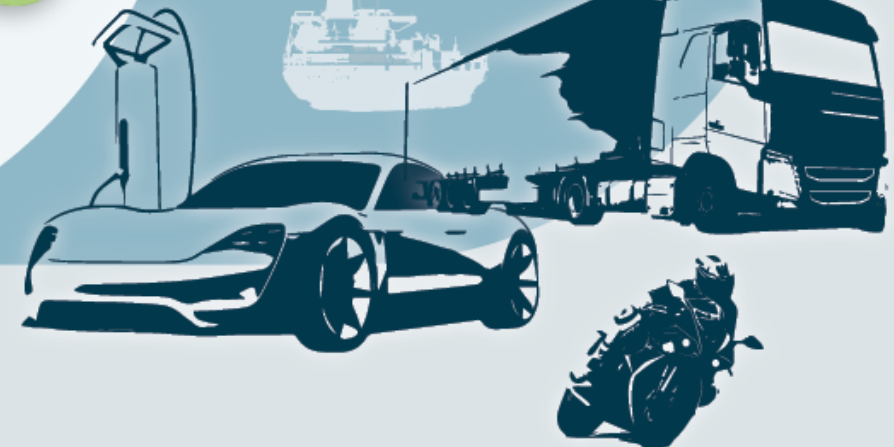
**Solution provided by the  
Combined Charging System (CCS)**






CO<sub>2</sub> neutral  
energy

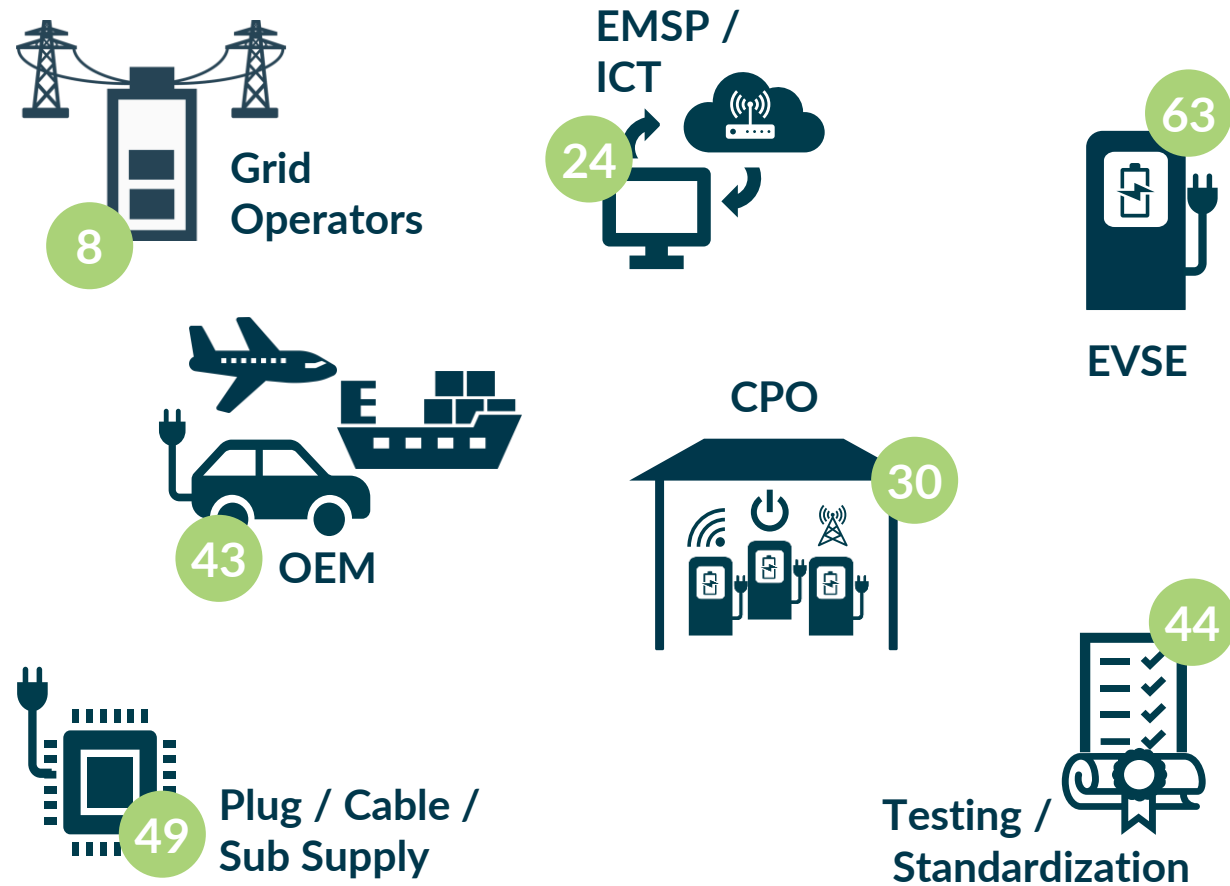


Battery Electric Vehicle (BEV):  
Forecast 40 Mio. vehicles  
by 2030 in Europe



- 114 Core Members
- 101 Regular Members
- 2 Associated Members

- 140  Europe
- 45  Asia / Australia
- 32  North America



### Focus Groups

#### Charging Connection



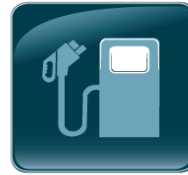
Harmonise future developments of coupler systems for AC and DC  
Develop recommendations for standardisation

#### Charging Communication



Support of development, specification and test of charging communication  
Close gaps and provide recommendations for communication protocols of the electric vehicle (EV) charging system

#### Charging Infrastructure



Harmonization of the ramp-up of CCS charging infrastructure and the involved charging process based on the market needs: removing market entry barriers for EV owners, charge point operators and manufacturers

#### Conformance Test | Interoperability



Requirements for Golden Test Device (GTD)  
Interoperability of customer use cases  
Enabling of multiple GTDs of manufacturers or test houses  
Achieve global acceptance of GTD

#### Grid Integration



Vehicle-to-grid/vehicle-to-home: regulations for standardisation  
Solving of technical issues  
Integration of end user view  
Dialogue with utilities

### Expert Team

North America

Europe

André Kaufung

Asia

Jacques Borremans



# One system for all

CCS and MCS

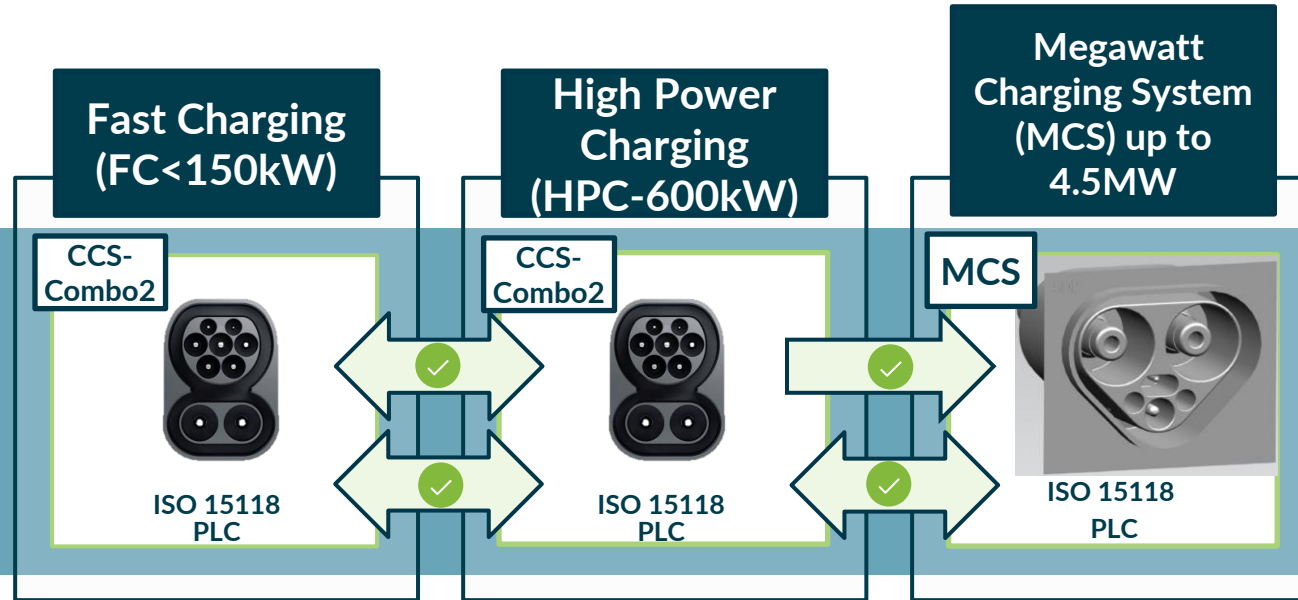
✓ Interoperable



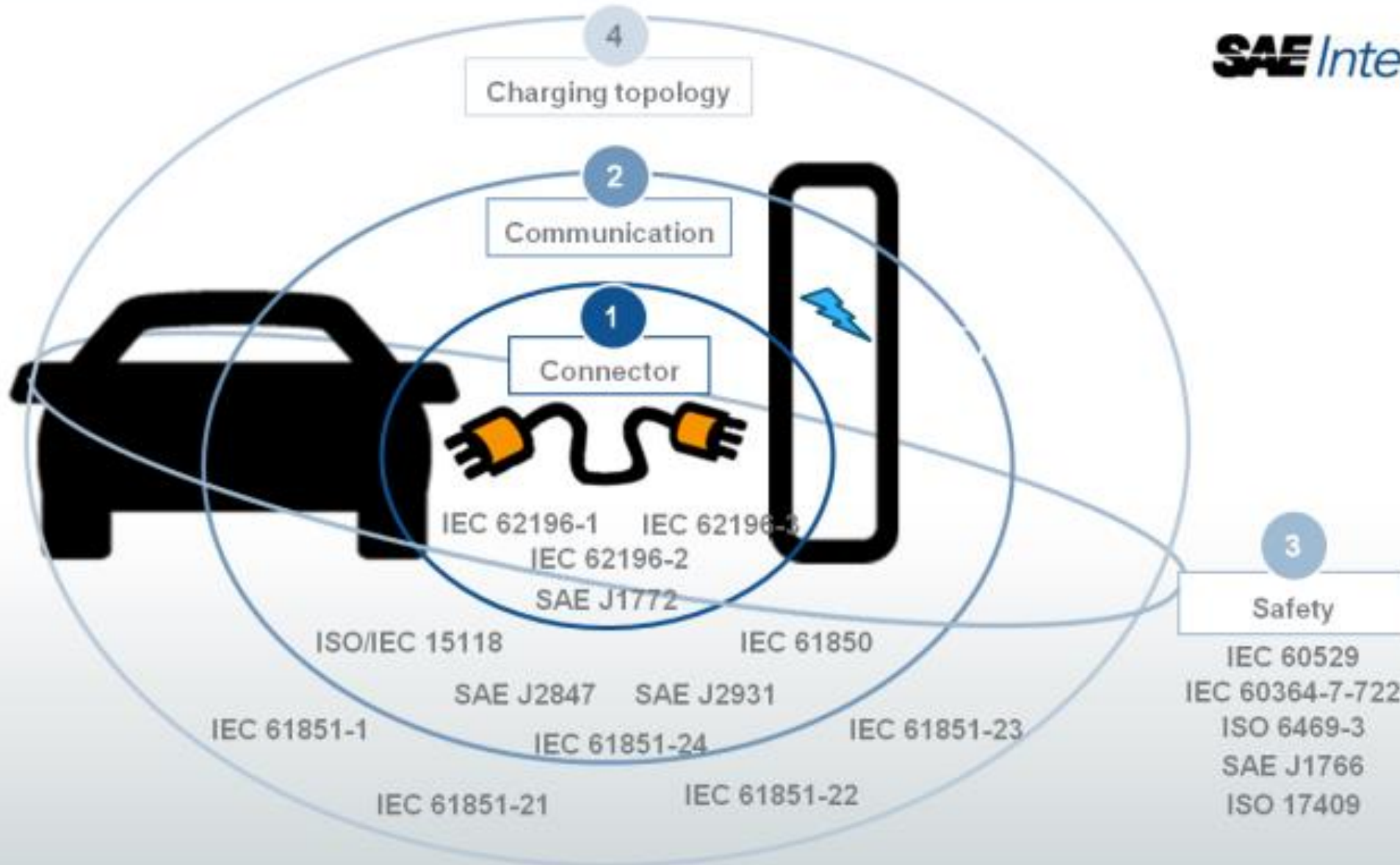
Global

DC-Connector

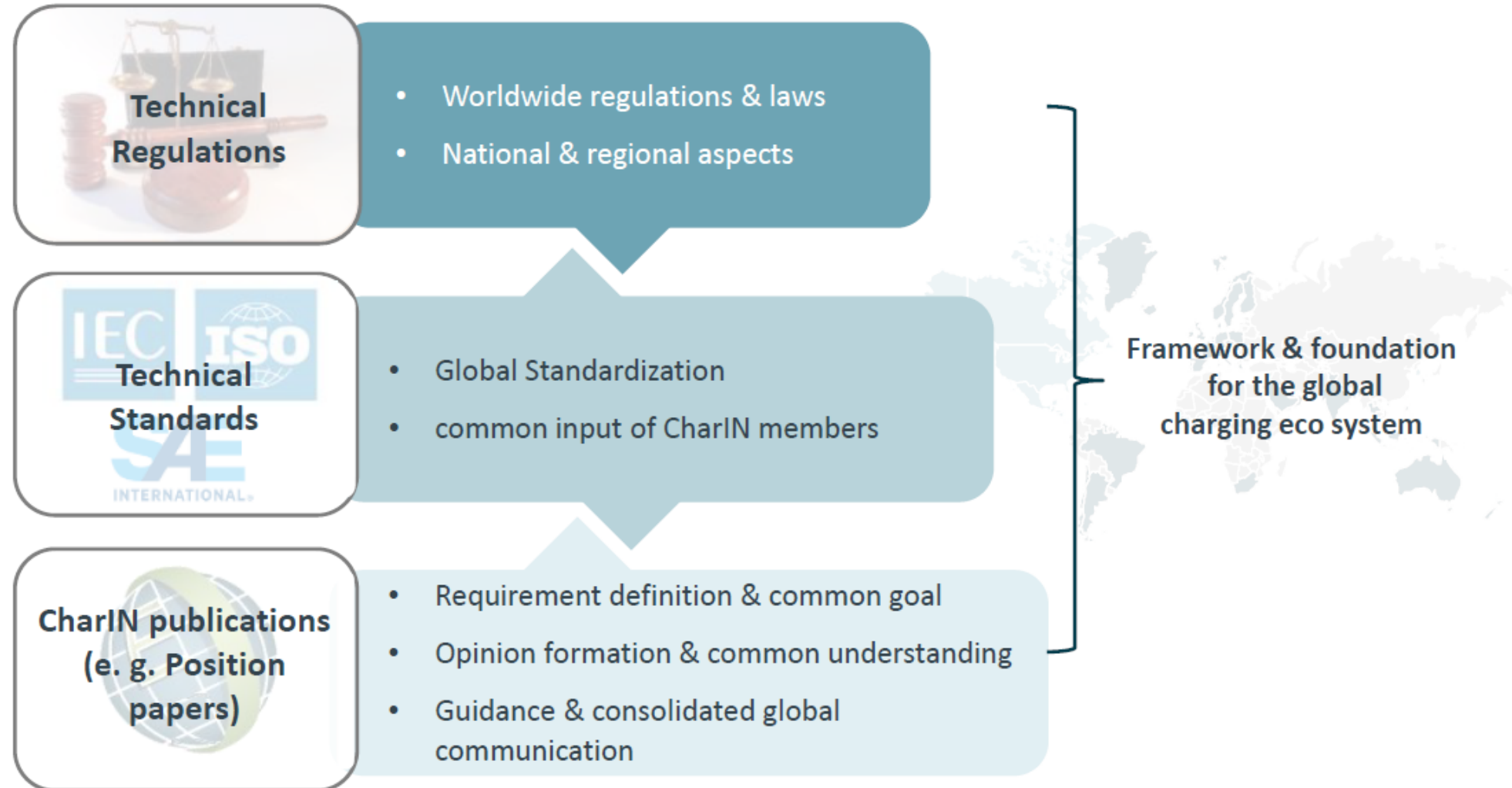
Communication



MCS



## Big picture CharIN's role in standardization



## Scope of application

- Motorbike | Car | Bus | Truck | Marine Vessels | VTOL | Planes





# E-Bus&E-Truck fleets have different charging requirements from family-used EV

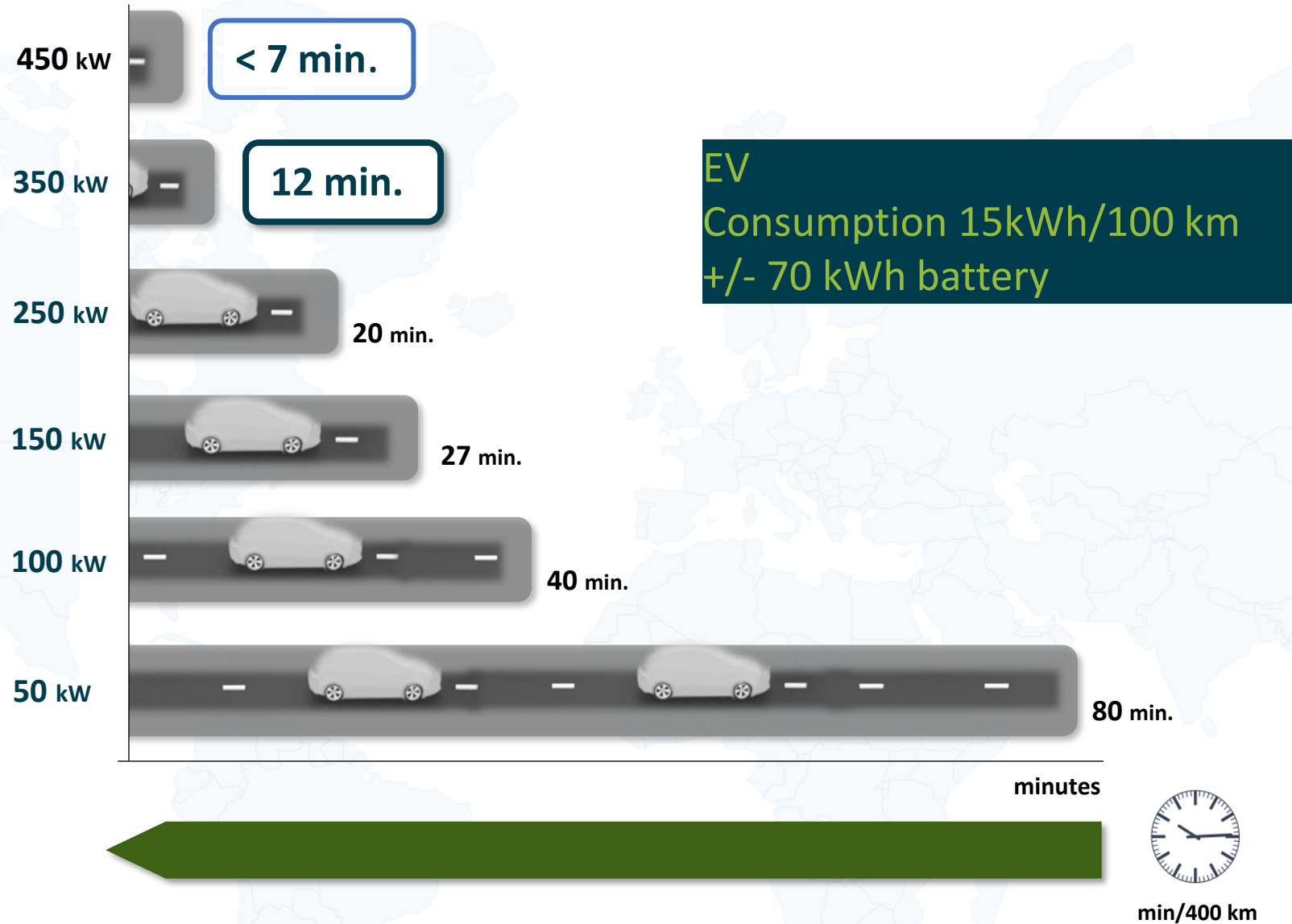


# Electric consumption of a bus can define size of battery

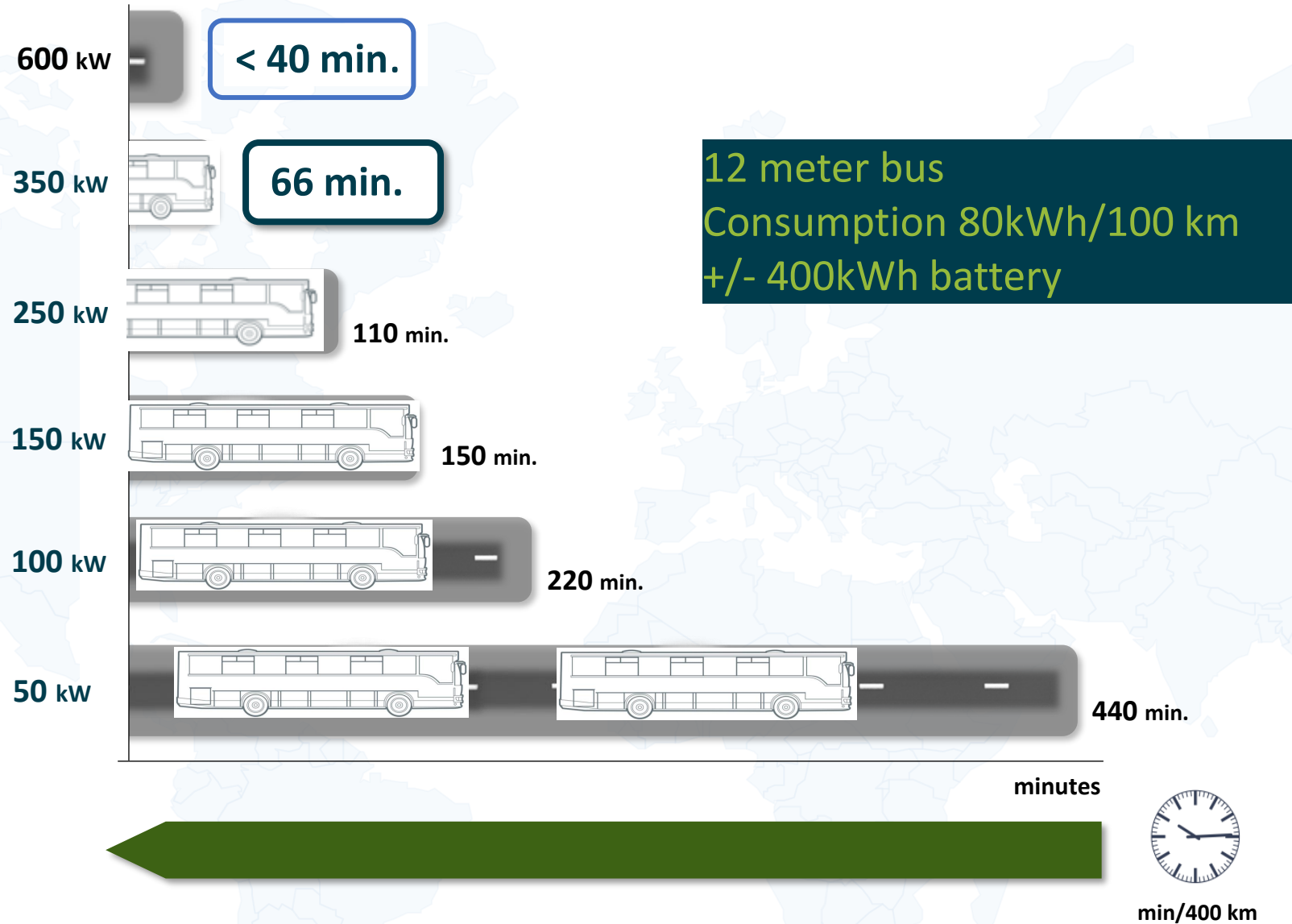
- BUT: COST & Physical Size of battery puts limitation on choice

Type of vehicle	kWh/100 km	Battery (kWh) for <u>Range</u> of 400km (20% safety margin)
Electric Car (EV)	15	72
12m e-bus	80	384
18m e-bus	100	480
24m e-bus	130	624
Double decker bus	130	600

# • Charging times for about 400 km range for family EV

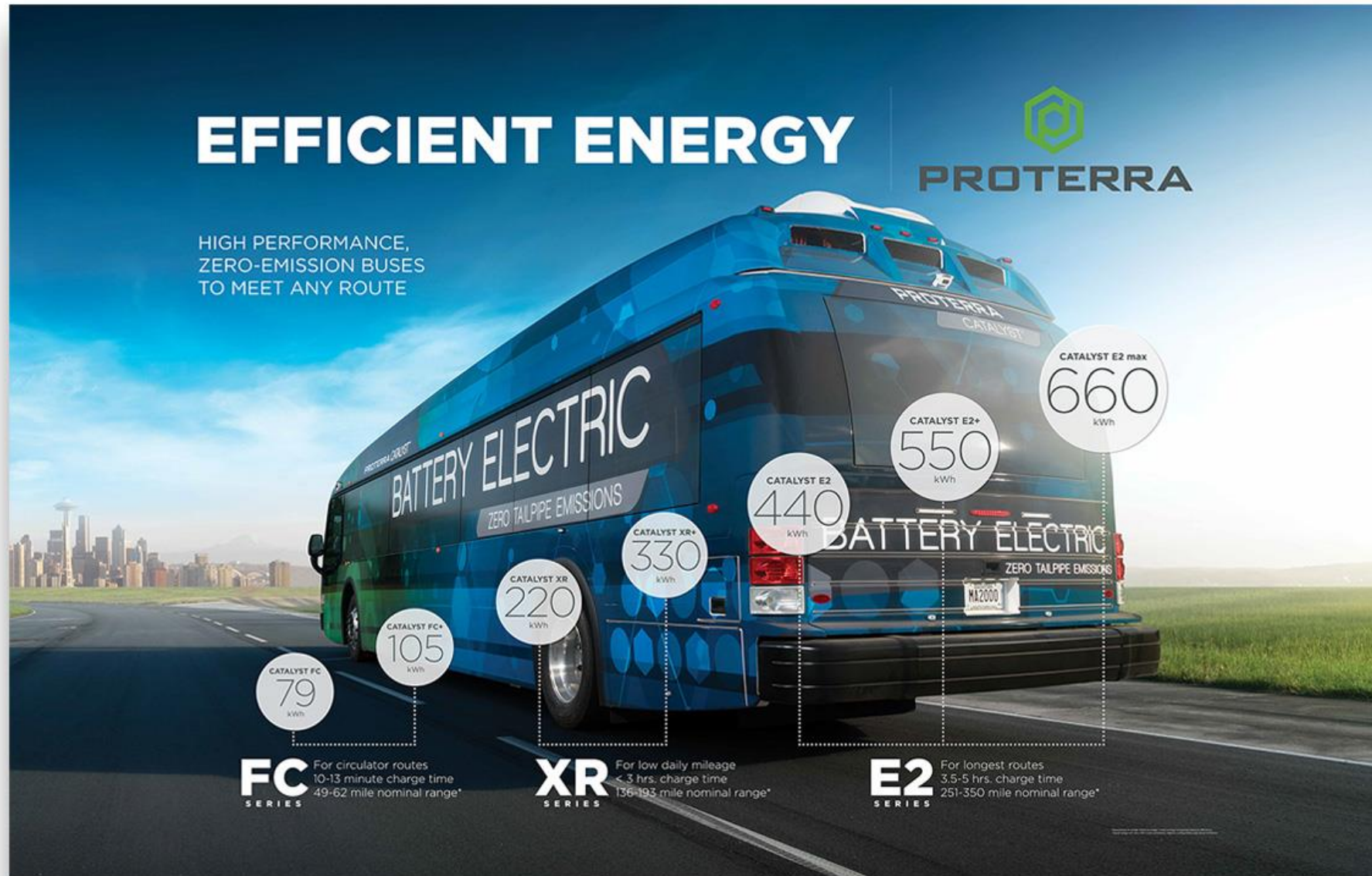


# • Charging times for about 400 km range for 12 meter bus





# Public Transport: Range vs charging time



**EFFICIENT ENERGY**

PROTERRA

HIGH PERFORMANCE,  
ZERO-EMISSION BUSES  
TO MEET ANY ROUTE

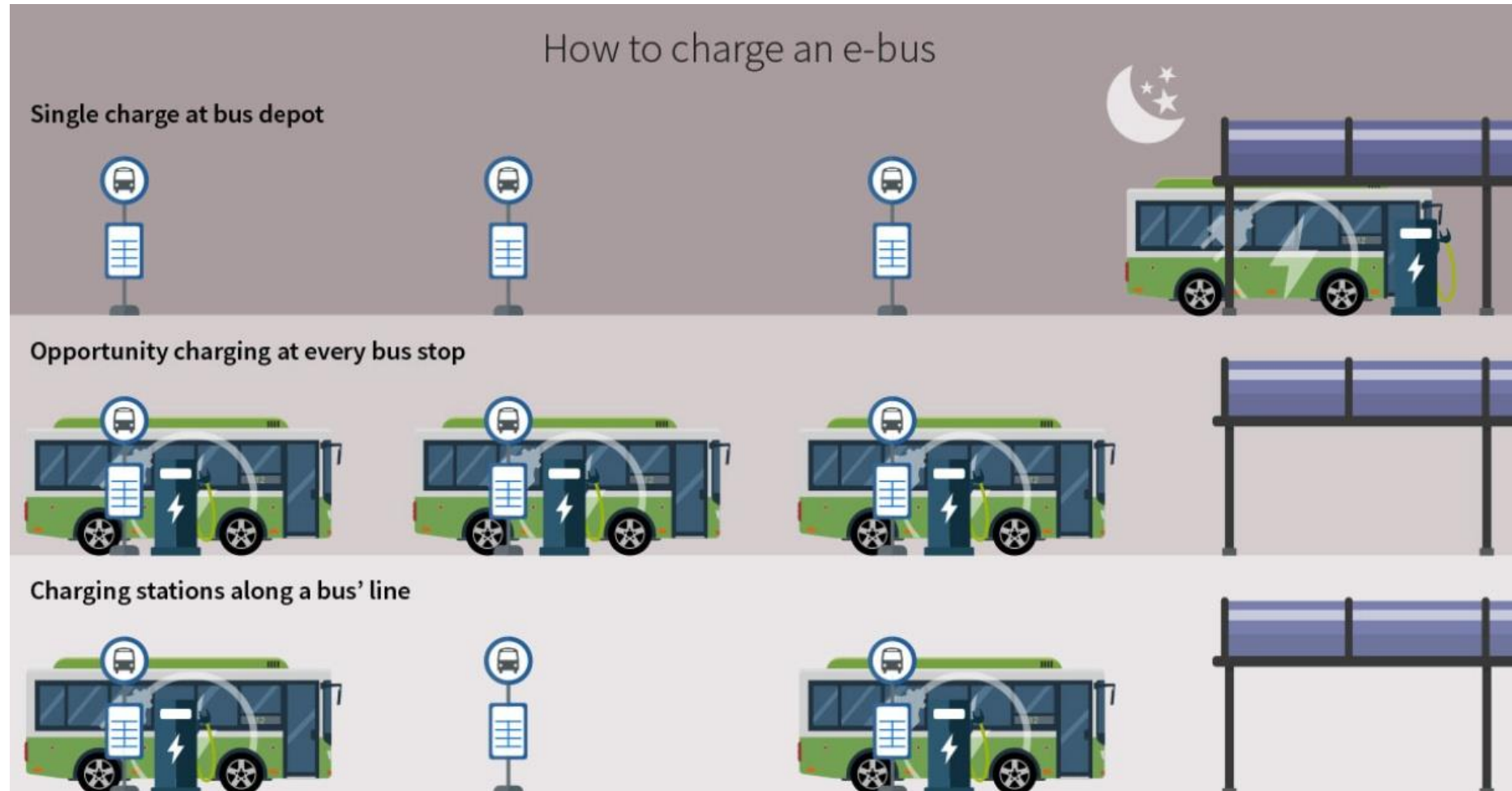
**BATTERY ELECTRIC**  
ZERO TAILPIPE EMISSIONS

**FC SERIES**  
CATALYST FC 79 kWh  
For circulator routes  
10-13 minute charge time  
49-62 mile nominal range\*

**XR SERIES**  
CATALYST XR 220 kWh  
CATALYST XR+ 330 kWh  
For low daily mileage  
< 3 hrs. charge time  
136-193 mile nominal range\*

**E2 SERIES**  
CATALYST E2 440 kWh  
CATALYST E2+ 550 kWh  
CATALYST E2 max 660 kWh  
For longest routes  
3.5-5 hrs. charge time  
251-350 mile nominal range\*

# Charging strategy or Charging infrastructure affects size of battery





## Pantograph

- For Opportunity charging



# Topography of the route will play a role in the lay-out of the Charging infrastructure



End point 

**Opportunity charging** during layover







End point 



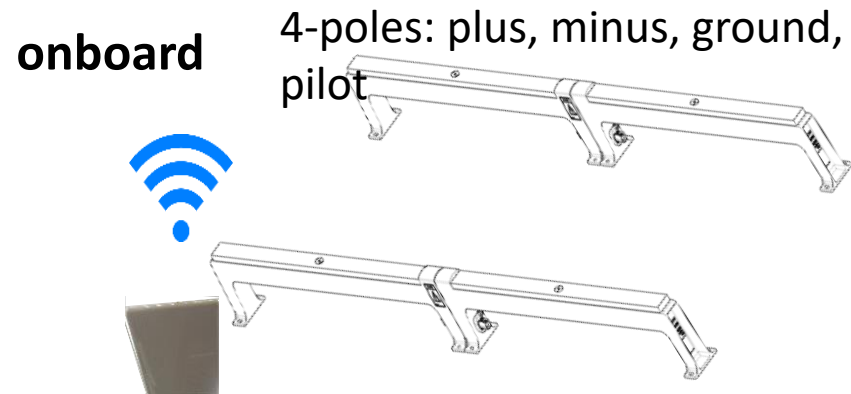
# Standards are important also for Pantographs

What is OppCharge?

OPPCharge



offboard



onboard

4-poles: plus, minus, ground,  
pilot



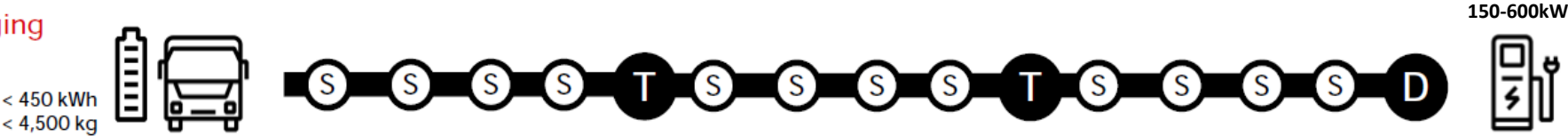
Charging is done according to:

- EN/IEC 61851-23
- ISO/IEC 15118
- DIN70121  
(aka CCS-2)

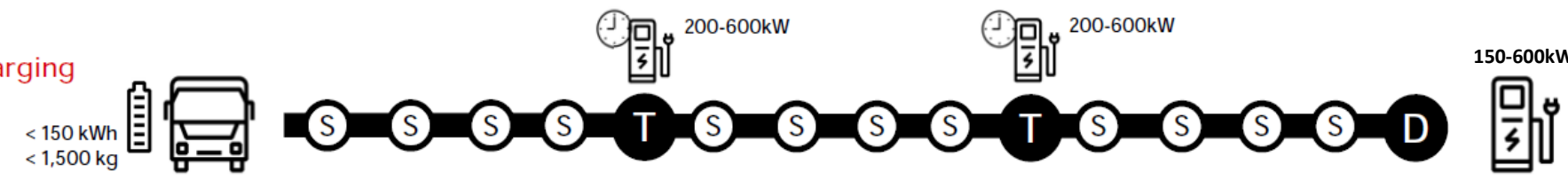
# The optimal trade off for batteries

Different solutions for different needs

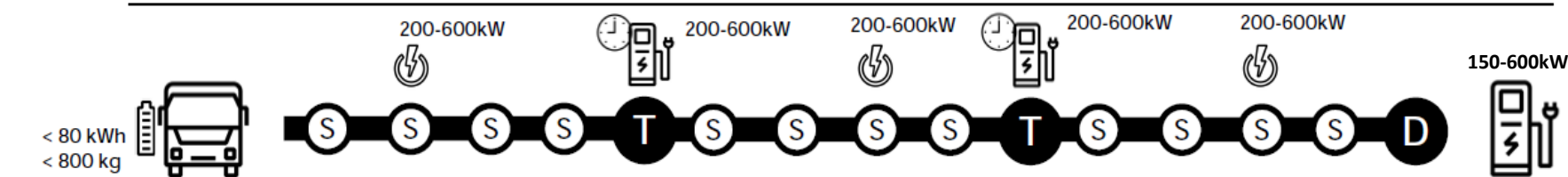
Overnight charging  
at Depot



Opportunity charging  
at Terminal



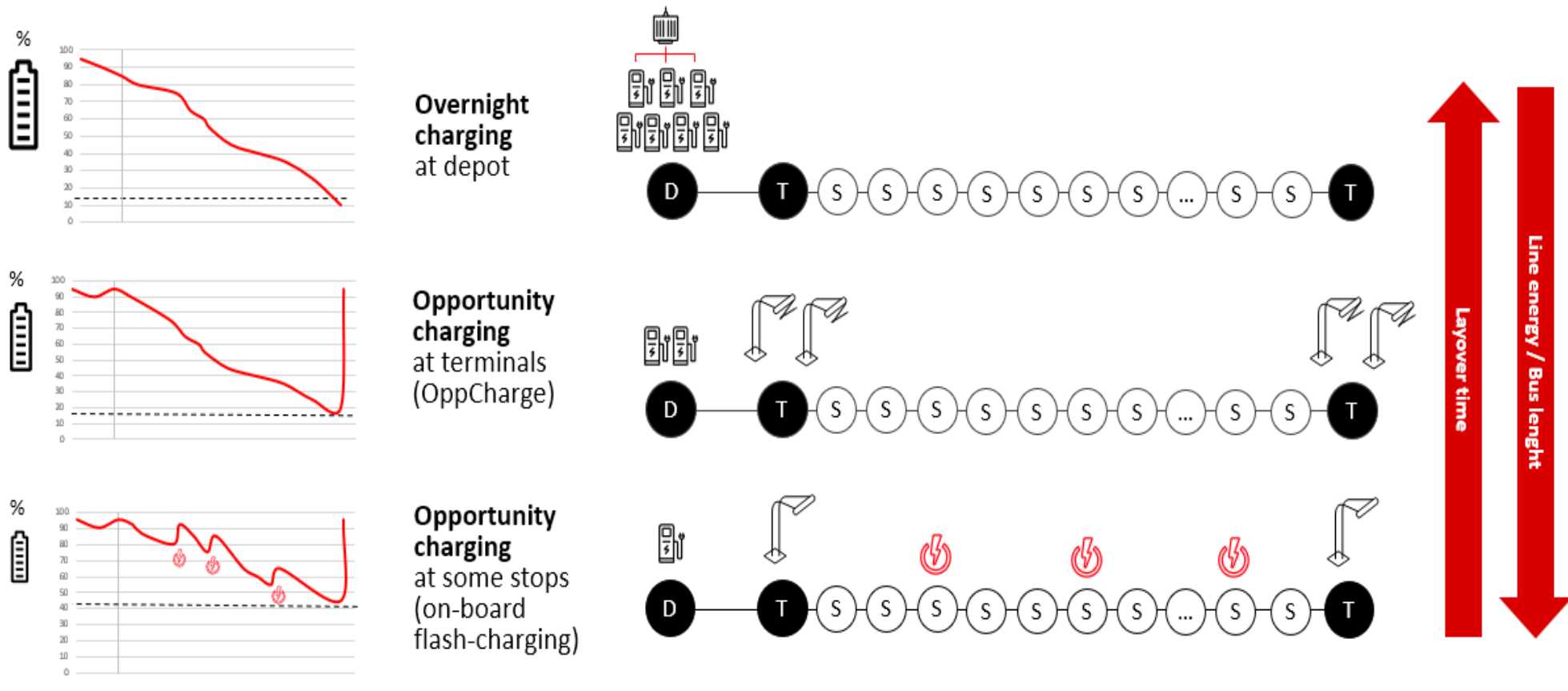
Flash charging  
At Stops



The optimal solution depends on multiple factors

# The impact on the utility grid and fleet operations

No down-time needed to charge the e-bus fleet, lighter charging infrastructure



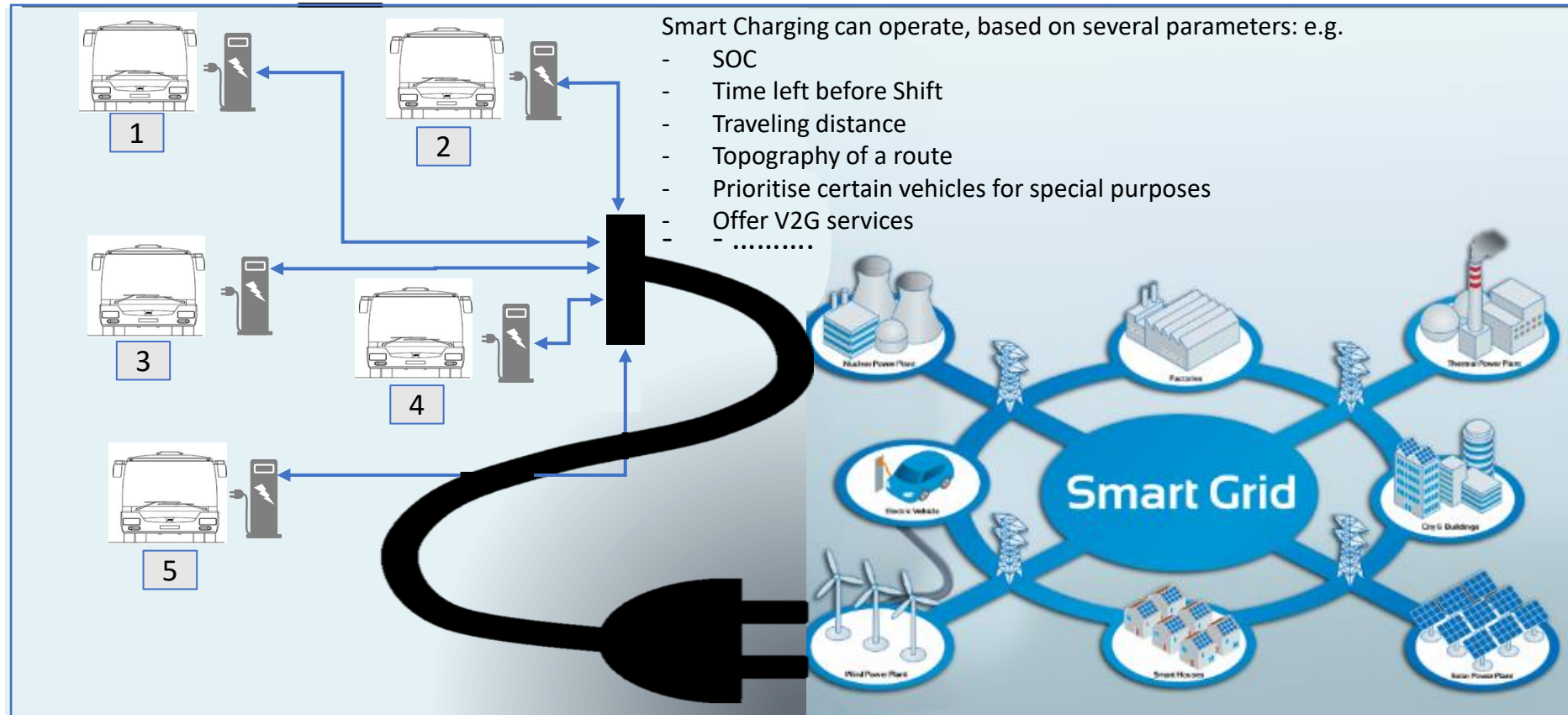




- Communication protocol: ISO 15118

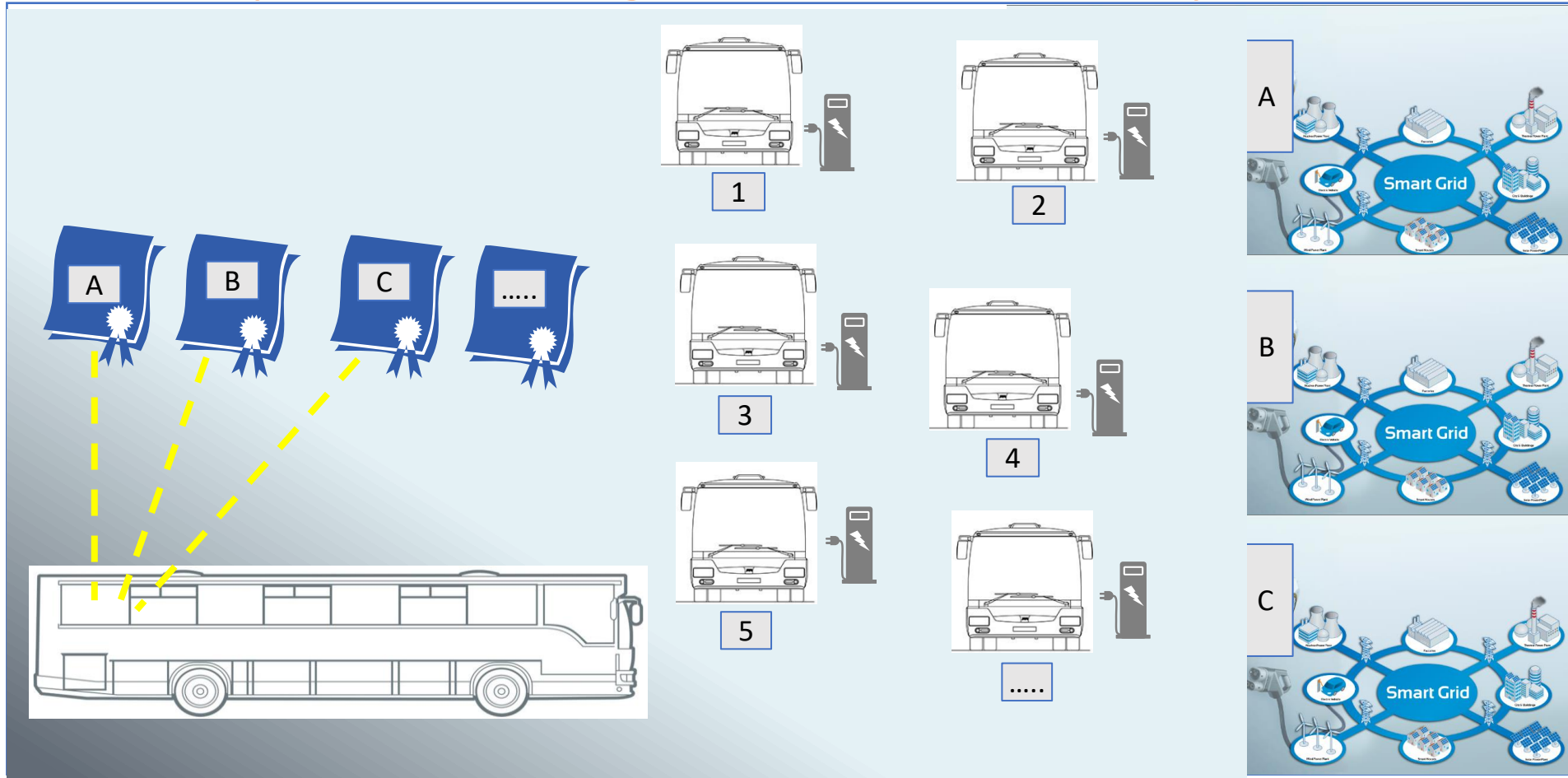


# Grid Integration// Smart Charging with ISO 15118

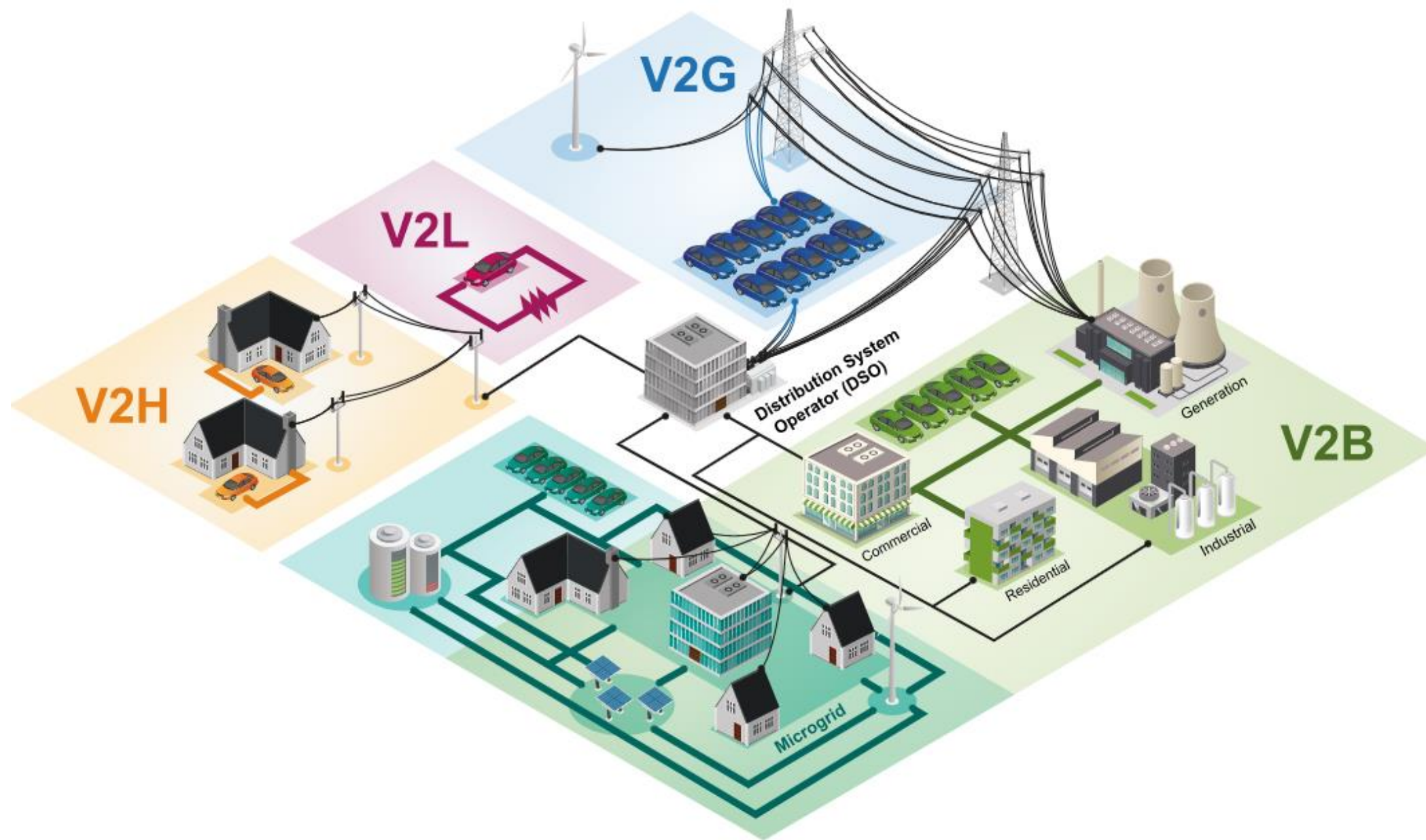


# Grid Integration// Smart Charging with ISO 15118

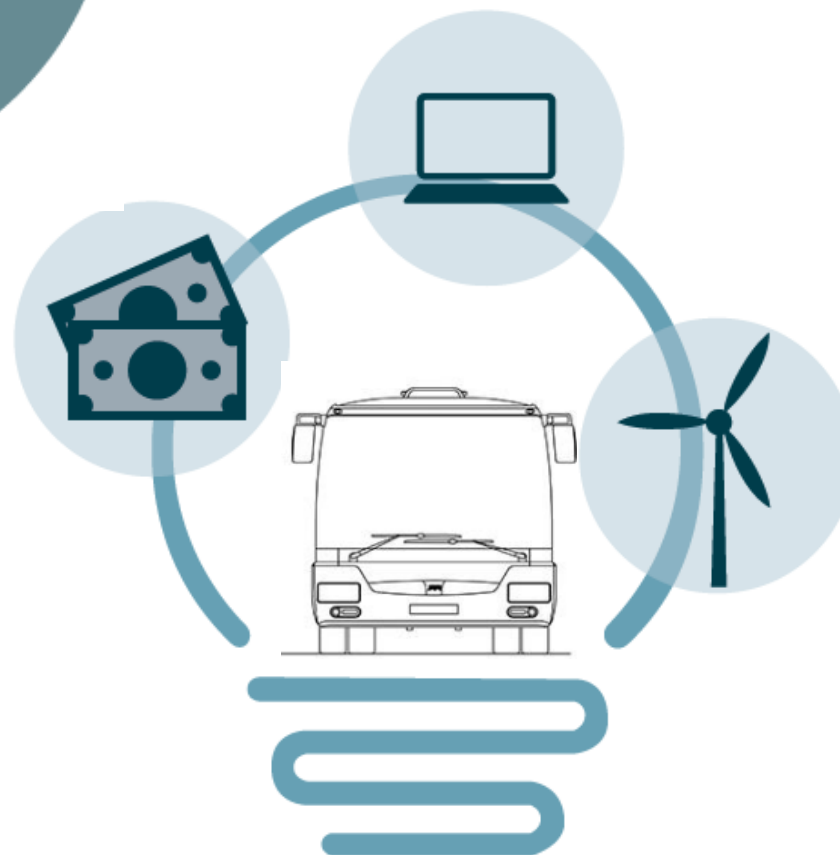
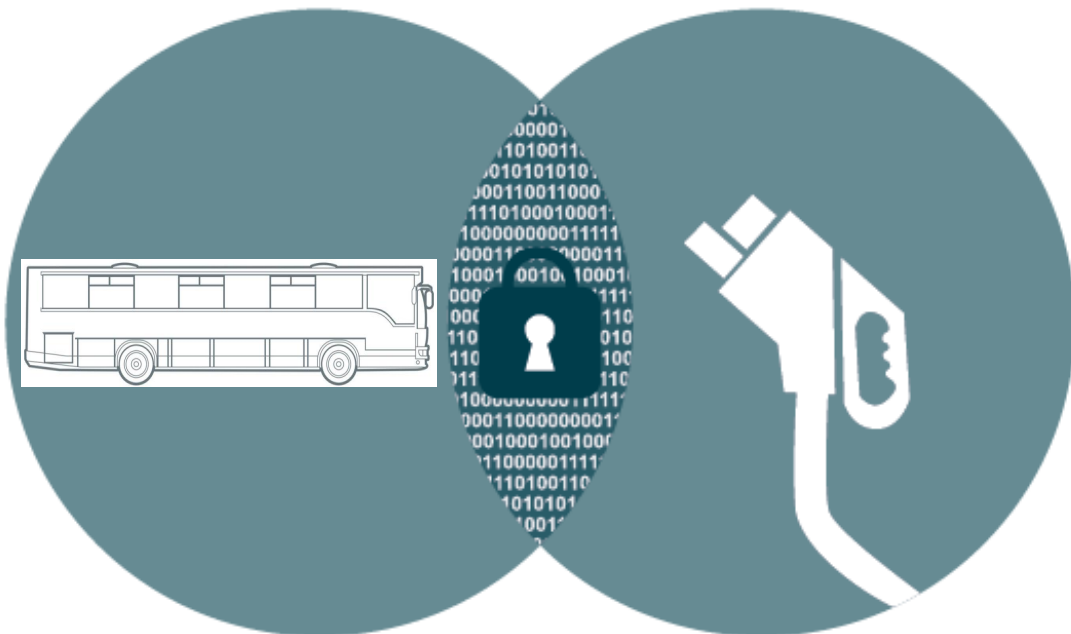
- Busses can negotiate with several grid operators for the cheapest purchases & highest sales of Electricity



# Grid Integration// Smart Charging

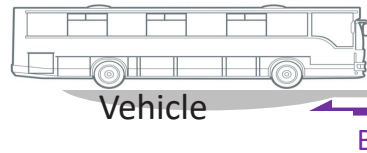






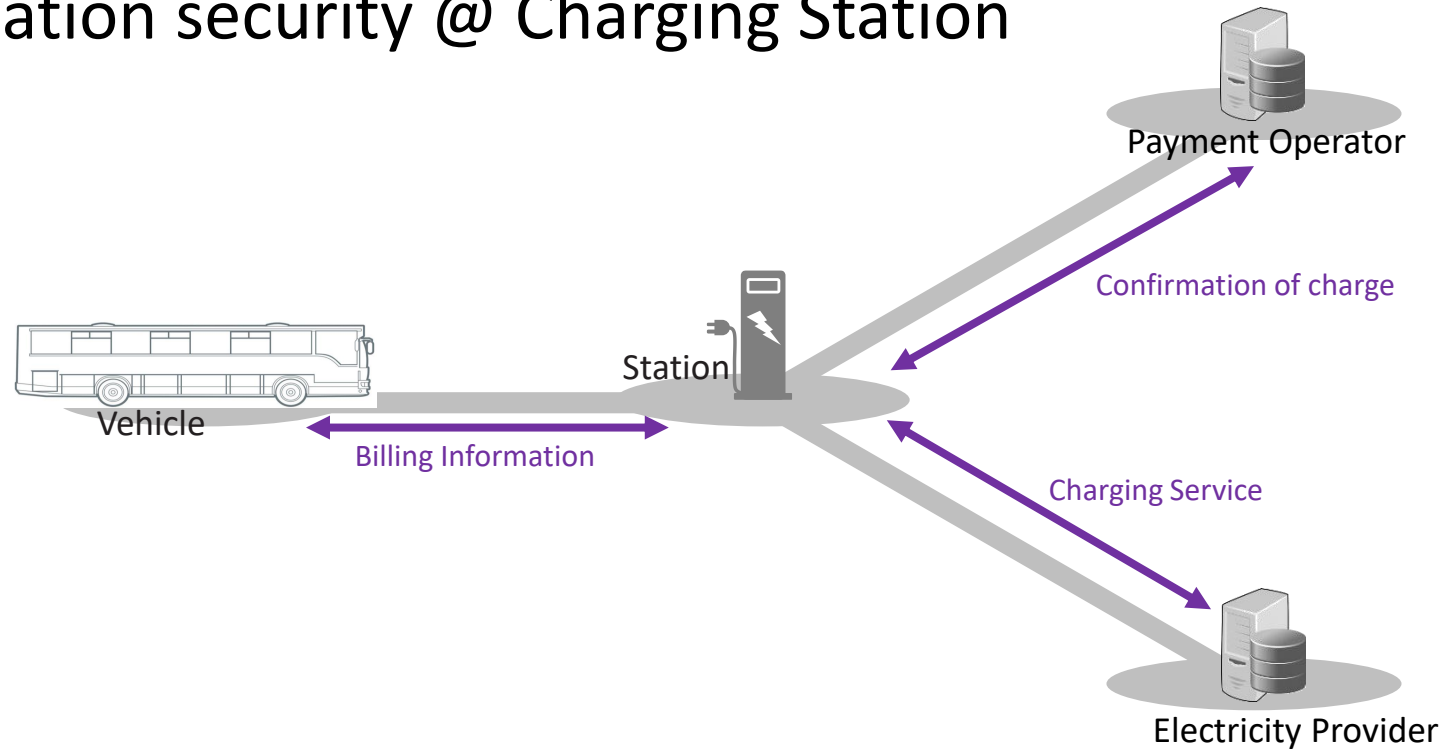
# Software: Security

- Communication security @ Charging Station



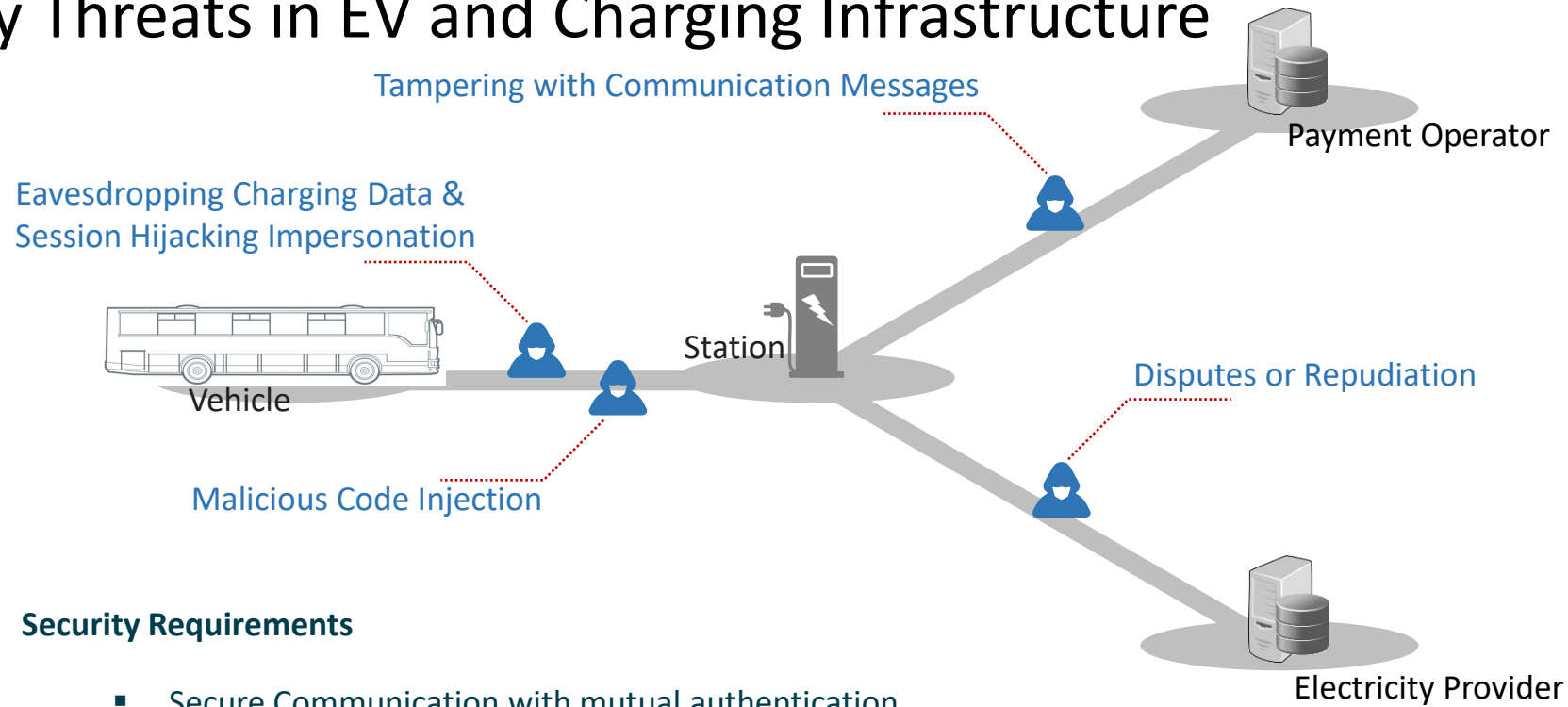
# Software: Security

- Communication security @ Charging Station



# Software: security

- Security Threats in EV and Charging Infrastructure



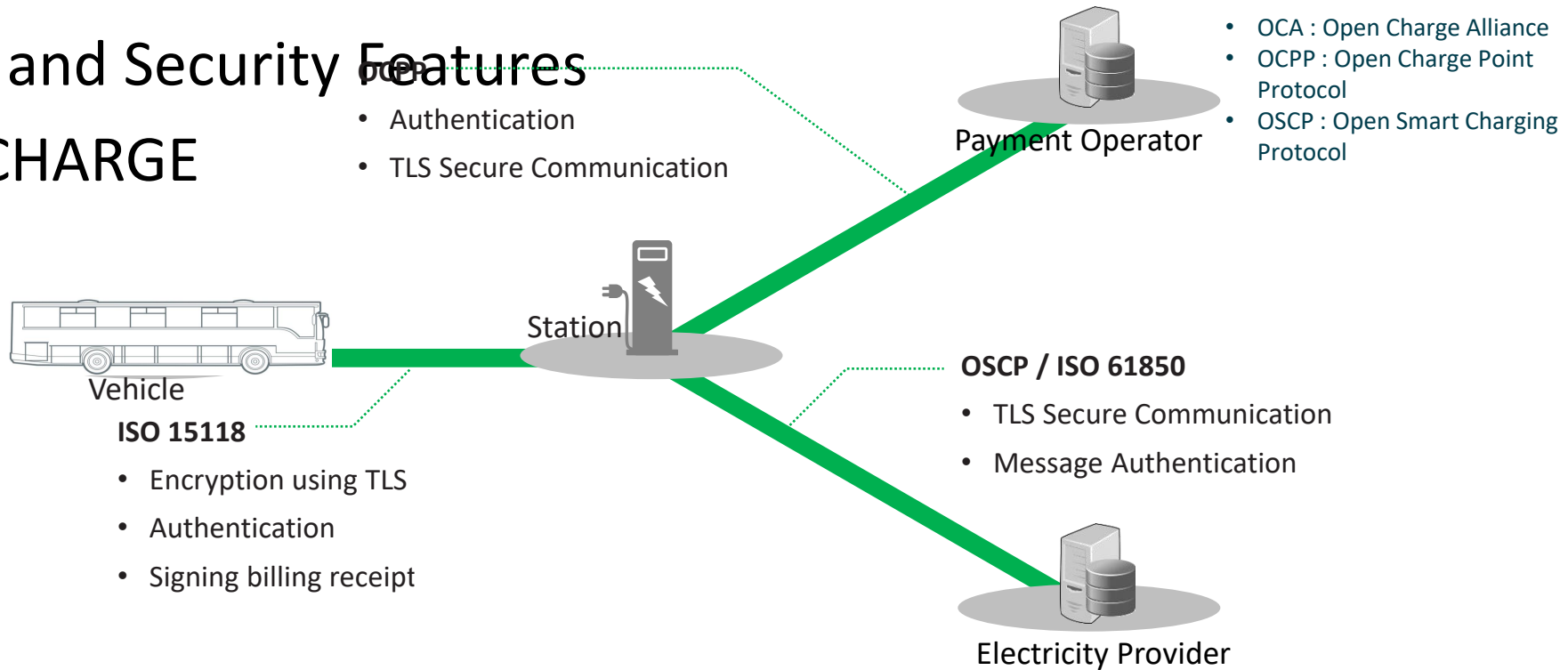
## Security Requirements

- Secure Communication with mutual authentication
- Integrity and non-repudiation for billing
- Confidentiality for personal & business information
- Availability of electricity



# Software: security

- Protocols and Security Features
- PLUG 'N CHARGE



## OCA

OCPP standardizes the communication between the charge spot and the party that operates the charge, thereby allowing CSO back-ends and charge spots of different vendors to communicate.

- OSCP(Open Smart Charging Protocol) allows a DSO (Distribution System Operators) to vary the capacity available to charge stations in time,

# When Encryption technology is missing Hackers could “power-jack” EV chargers to cause blackouts and steal data, study finds

*IS THAT PLUG SAFE? —*

How big is the risk that someone will hack an EV charging network?

EV chargers are on the spectrum of the Internet of Things, and that means risk.

GORDON FELLER - 7/27/2022, 1:49 AM

CHARGING TECHNOLOGY

## Shocking: Hacked electric vehicle chargers display porn sites



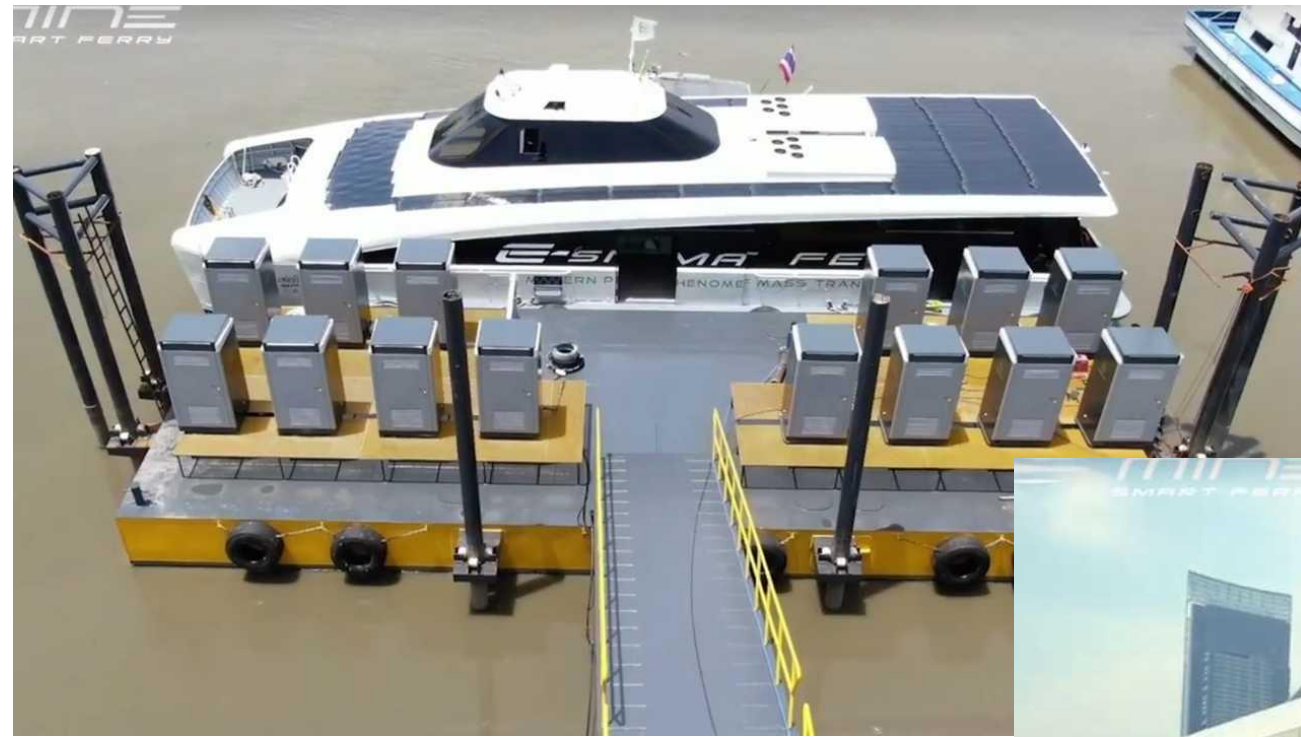
By JAMES BILLINGTON — April 7, 2022

No Comments

# Long distance Transport



# Bangkok Ferry



14 Chargers with 28 sets of CCS-  
Combo2 plugs





## Megawatt Charging System

### Motivation and Scope

A CharIN task force was formed in March 2018 with the following purpose statement:

“Define a new commercial vehicle high power charging standard to maximize customer flexibility.” It was named the High Power Charging for Commercial Vehicle Task Force (HPCCV for short) and later changed to “MCS” for “Megawatt Charging System”.



#### Requirements (not a complete list)

- Single conductive plug
- Max 1.500 VDC
- Max 3.000 ADC
- PLC+ ISO/IEC 15118
- Touch Safe (UL2251)
- On-handle software-interpreted override switch
- Adheres to OSHA & ADA (&local equivalent) standards
- FCC Class A EMI (&local equivalent)
- Located on the left side of the truck, roughly hip-height
- Capable of being automated
- UL (NRTL) certified
- Cyber-Secure
- V2X (bi-directional)

# One system for all

CCS and MCS

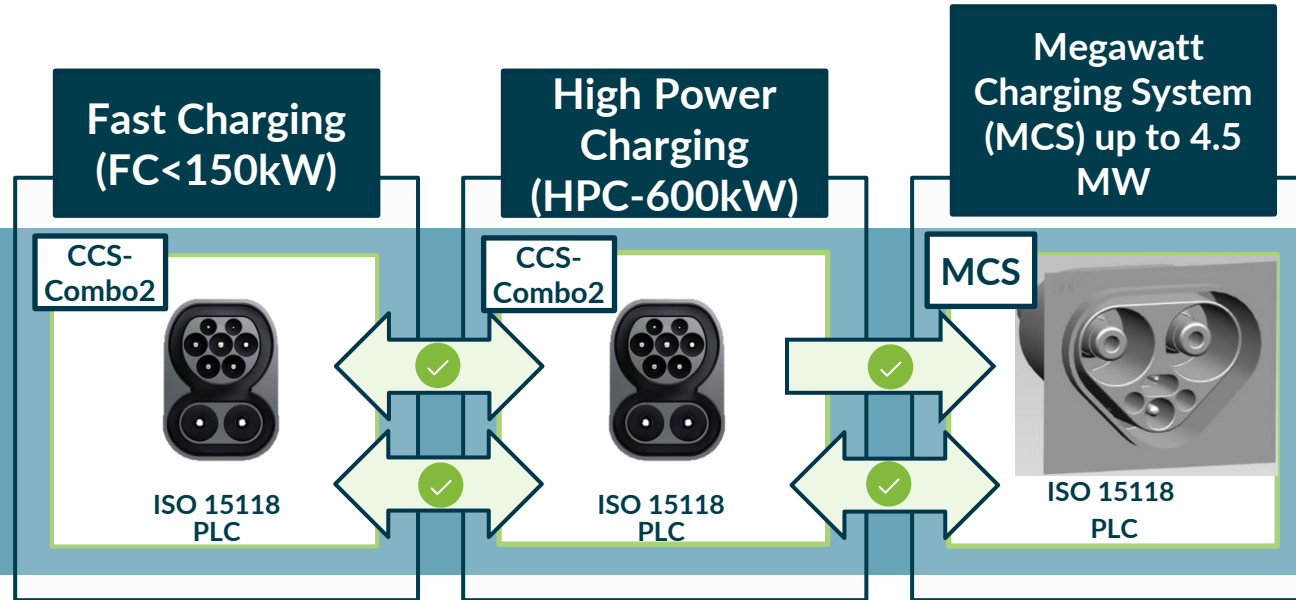
✓ Interoperable



Global

DC-Connector

Communication



Marine:

Aeronautics:

# MCS

One System for  
all  
Automotive  
E-bus/Truck  
Industrial EV  
Marine  
Aeronautics

# MCS





# MCS

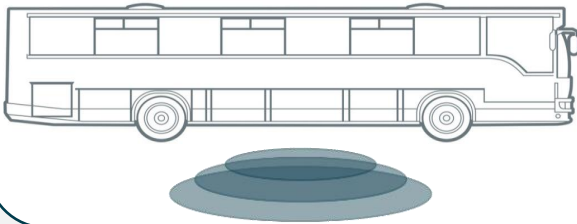






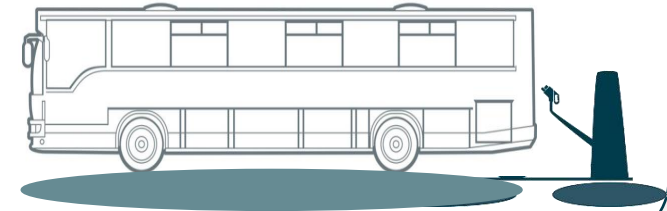
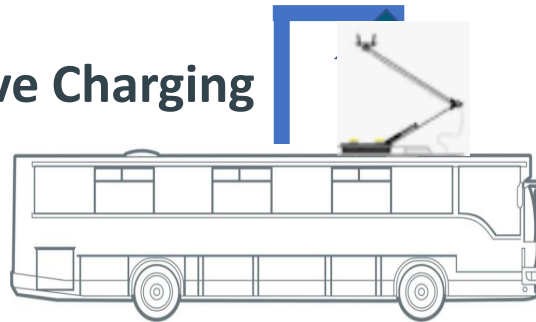
# User applications with ISO 15118

AWC | ACD | PnC



**Automated Wireless Charging**

**Automated Conductive Charging**



**P<sub>n</sub>C**

**Plug & Charge**



# Pantograph Charging



## CCS

### Advantages of ISO 15118

Charging System	Communication Protocol	DC	AC	TLS	PnC	ILF	WPT	BiDi	ACD
CCS	ISO 15118-20 Ed. 01 (2022)	✓	✓	✓	✓	✓	✓	✓	✓
	ISO 15118-02 Ed. 01 (2014)	✓	✓	✓	✓	✓	X	X	X
	DIN SPEC 70121: Ed. 01/02/03	✓	X	X	X	X	X	X	X



#### ISO 15118-20 Ed. 01 adds additional features and charging methods

For the first time, implementation of ISO 15118-20 Ed. 01 will serve all use cases to enable seamless introduction of electric vehicles.

AC – Alternating current charging

WPT – Wireless Power Transfer

ILF – Smart charging function / Intelligente Ladefunktionen

TLS – Transport Layer Security

DC – Direct current charging

PnC – Plug & Charge

BiDi – Bidirectional charging

ACD – Automatic connection device

\*Limited bandwidth due to CAN bus based physical layer



# Electric Island

First of its kind public electric truck charging site in Portland, Oregon. Partnership between Portland General Electric and Daimler Trucks America (PGE & DTNA). Is prepared for installation of MCS charger and Battery Storage.





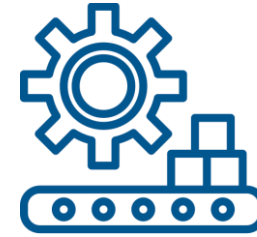
### HoLa essentials

- ❖ Demonstration and real-life testing of MCS
- ❖ Knowledge base for a nationwide expansion of MCS in alignment with NLL activities
- ❖ Accompanying the standardization of MCS
- ❖ Start with CCS charge points at four sites
  - Two locations at motorway
  - Two locations at logistics centers
- ❖ Upgrade of all four sites with MCS interface in second phase
- ❖ Operation of prototype trucks from four major truck OEMs



#### 13 consortium partners

funded by the Federal Ministry of Transport and Digital Infrastructure



#### 4 truck manufacturers

Daimler, MAN, Scania, Volvo



#### 12 electric trucks

8x CCS trucks  
4x MCS trucks



#### 8 associated partners

supporting with knowledge and resources



#### 4 charging sites

between Dortmund & Berlin



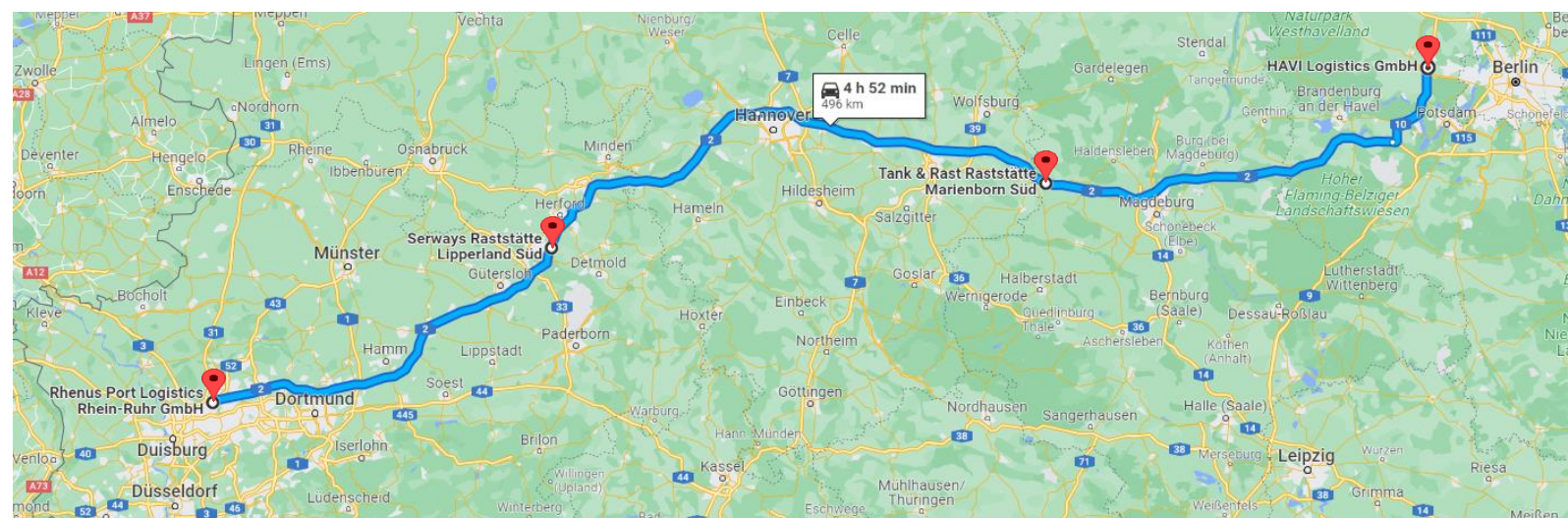
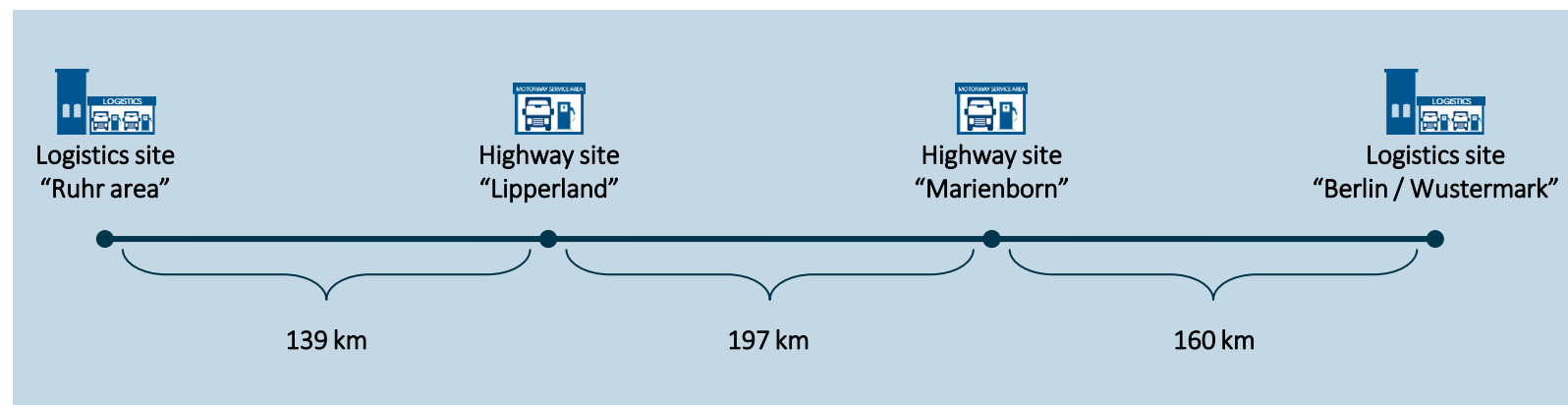
#### up to 1 MW

charging power per charge point



### HoLa corridor specifications

Route	Ruhr area to Berlin along highway A2
Total distance	496 km
# of sites	4
# of CCS charge points	8
# of MCS charge points	8
Total grid power	11.4 MW
# of vehicles	12



# Project description

The innovation cluster project High Power Charging for Trucks/Busses (acronym: HoLa), funded by the German Federal Ministry, plans to install and operate the first megawatt charging stations for trucks/busses in Europe.



## Timeline





# CharIN Testival and 6th Conference **NORTH AMERICA** 2022

October 4-7, 2022

Portland, Oregon (USA)

Host: Daimler Truck North America LLC.

**Tester registration deadline: September 16th**

• [Register here](#)



MCS  
  
TESTIVAL





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Thank you for your kind  
attention!



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@worldwideccs



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