



EV Charging Ecosystem and Technology Trend of Electric Vehicle Supply Equipment

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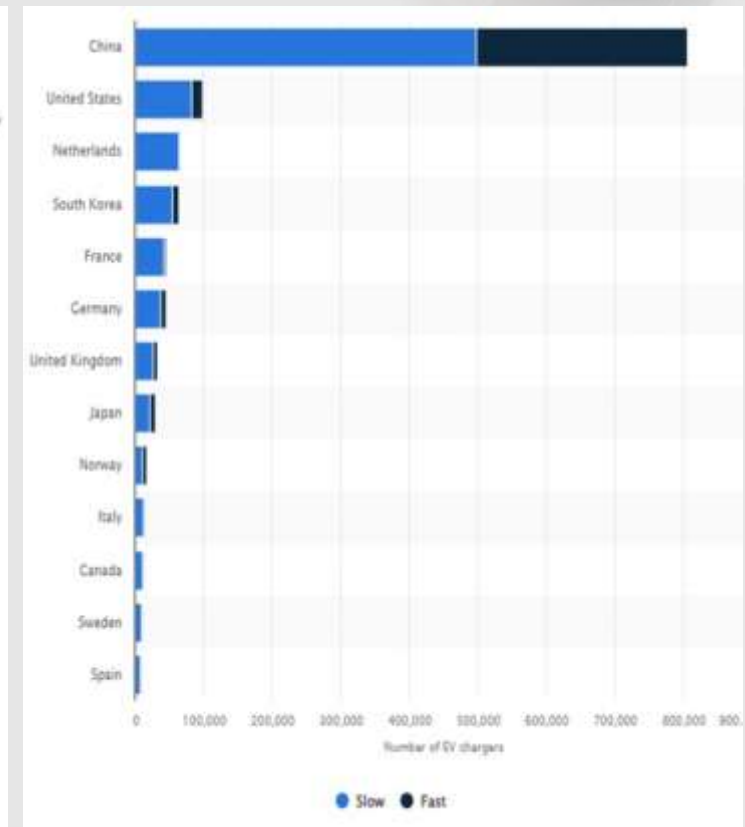
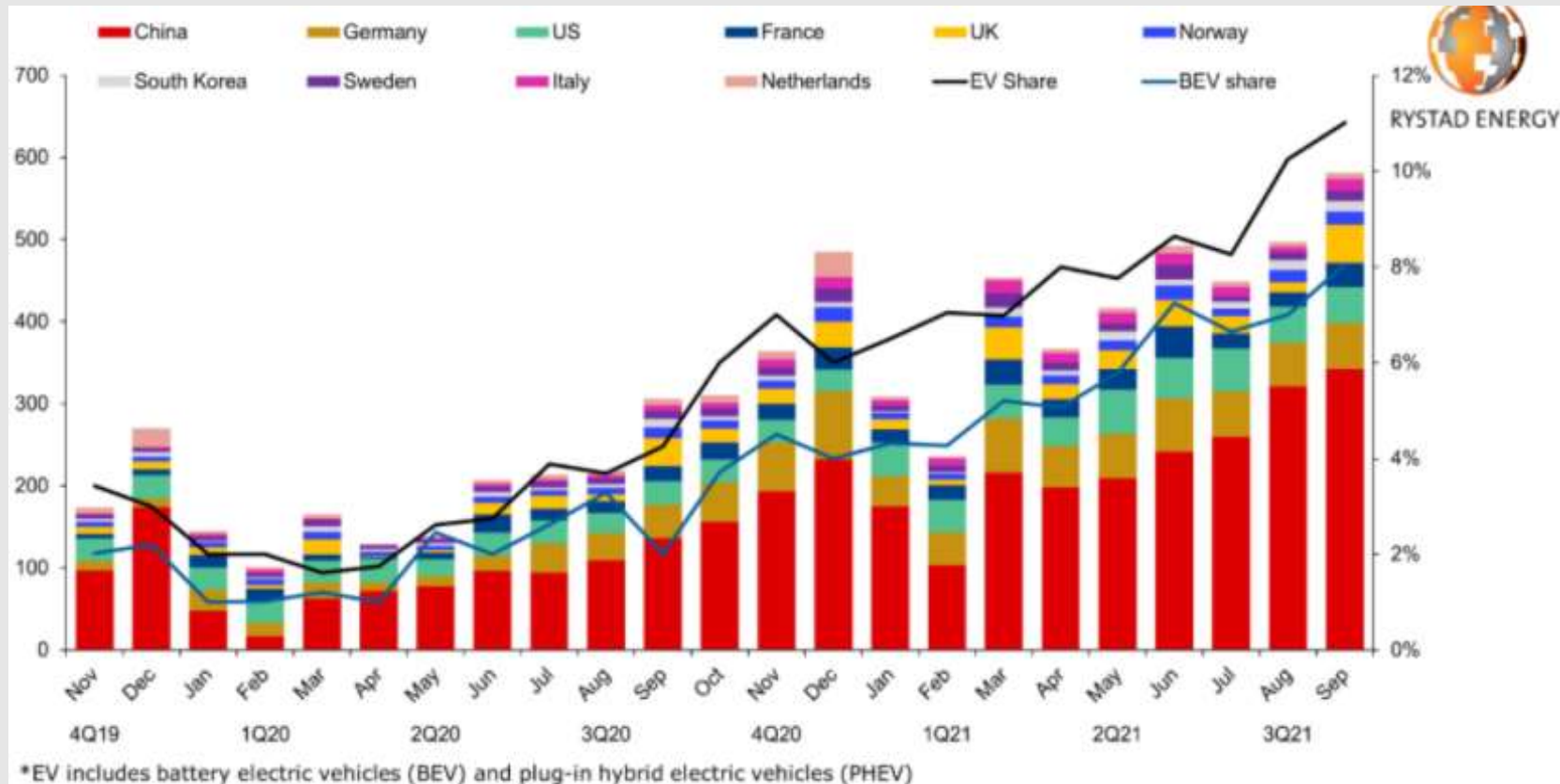


PROFESIONAL
OPTIMIS
PRODUKTIF

Outline

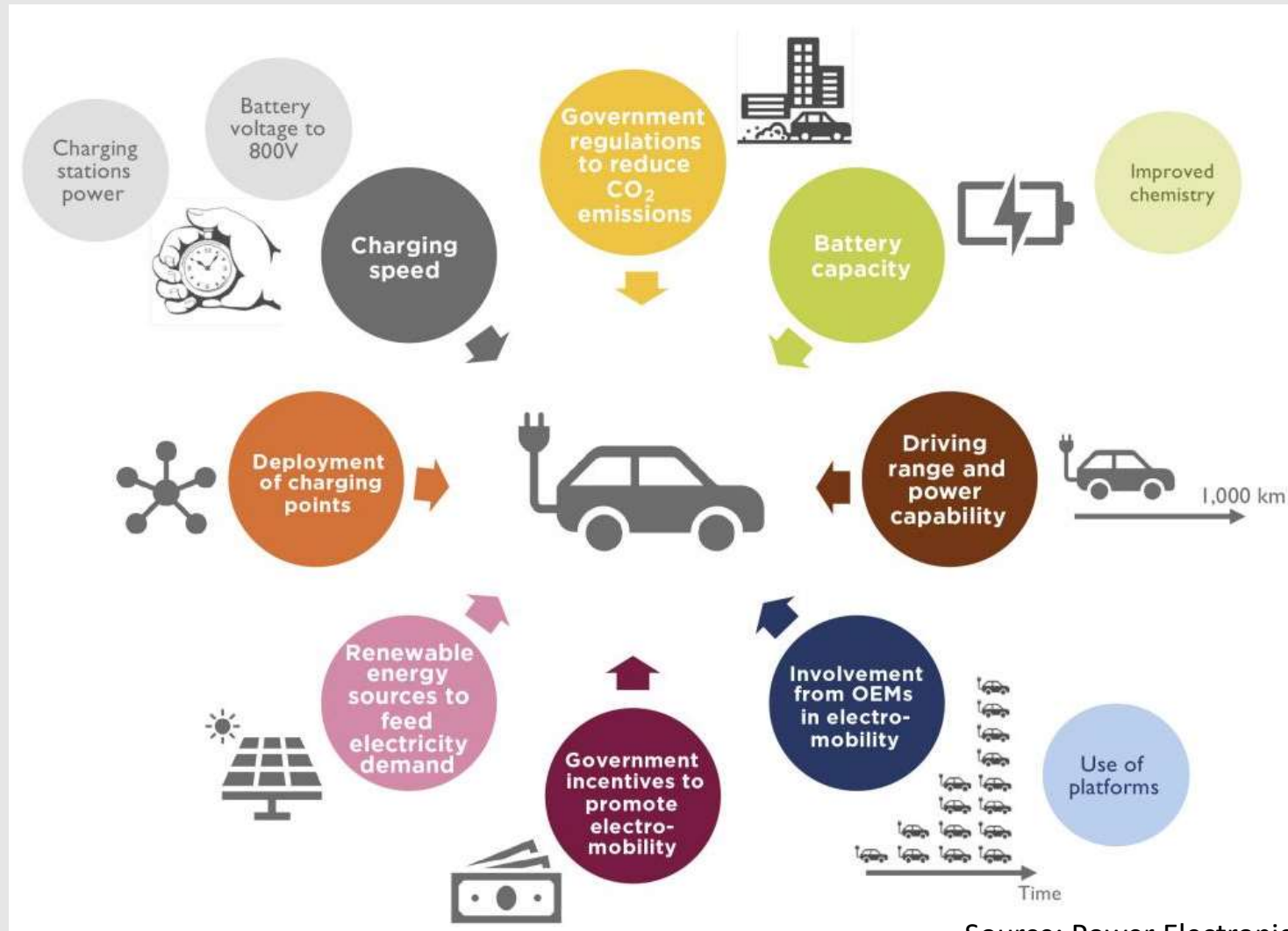
- Global EV
- EV Mobility Ecosystem
- Recent EV Technology and Charging Process Mechanism
 - 800 V EV Platform
 - High Power Charger
- BRIN Research Activities :
 - Hardware
 - Software

Global EV Growth



- The number of EVs in the world has reached 16 million units and electricity consumption has reached 30TWh/year (source: IEA 2022).
- Total sales of EV 2021 reached 6.75 million units, 71% BEV and the rest PHEV.
- China dominates with total sales of more than 3 million units, followed by Europe (2.3 million) and America (735 thousand).

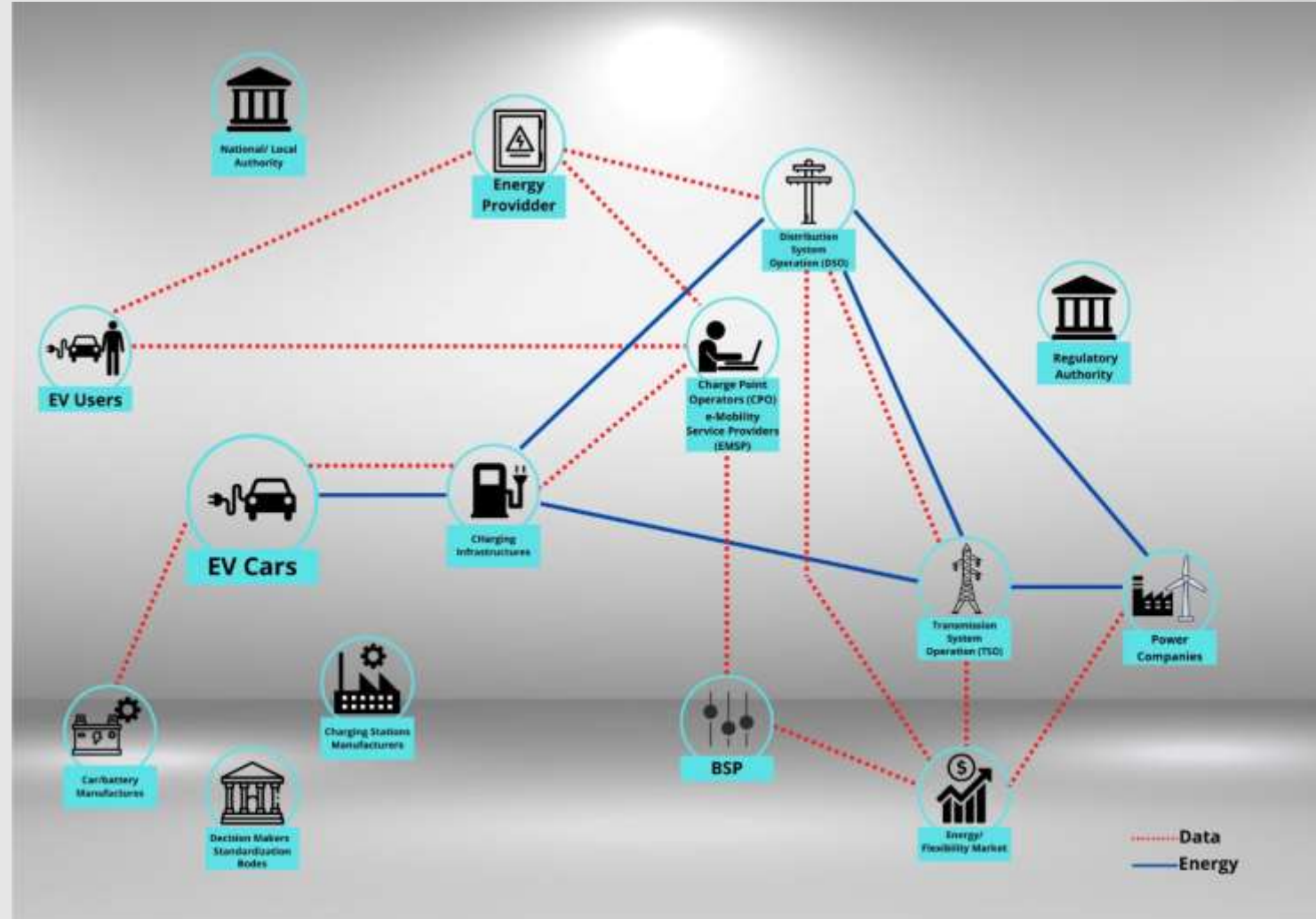
Pusher and Enablers for E- Mobility



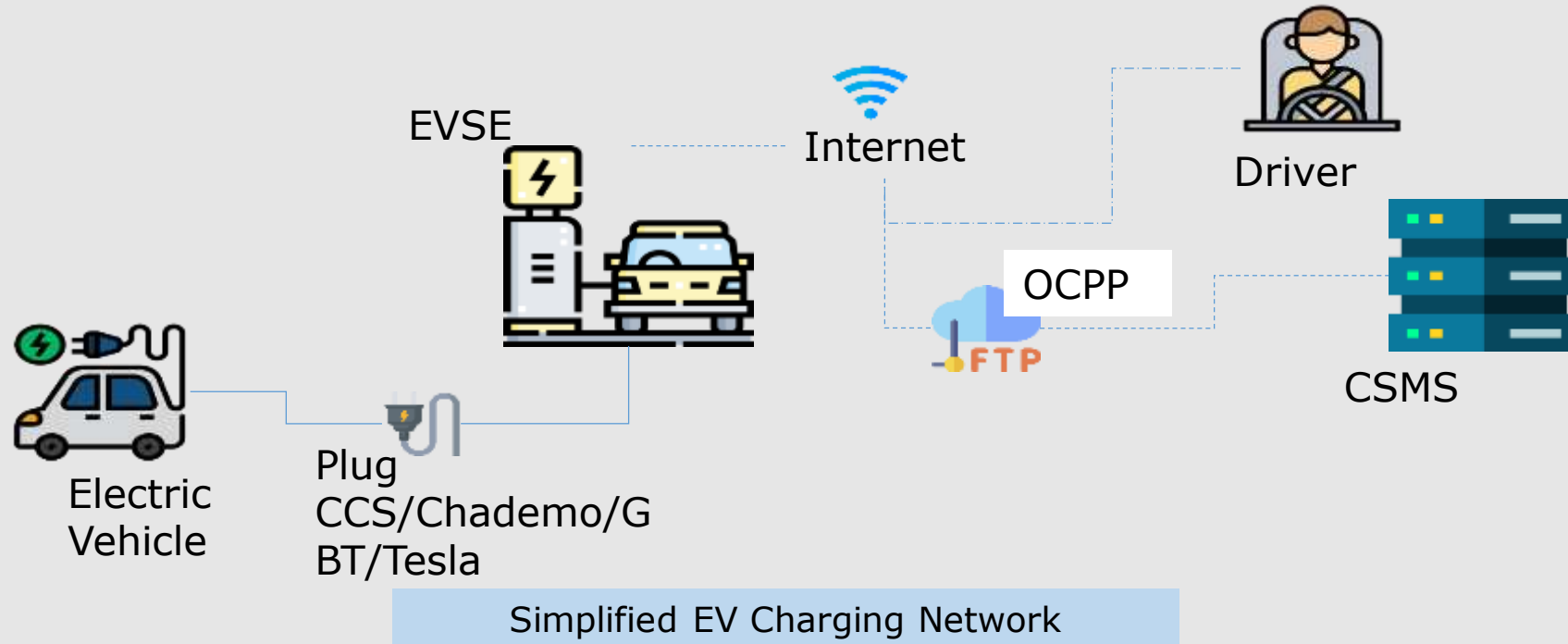
Source: Power Electronics for E-Mobility 2021
report, Yole Development 2021

EV Charging Infrastructure

- EV does not concern only on the provision of EVSE (electric vehicle supply equipment), but also requires strong electrical and ICT infrastructure support
- Cash-less and no-operator
- ICT for e-mobility :
 - Network and data communication system
 - Mobile apps
 - Back-end system :
 - OCPP server
 - Central control system (Charging Station Management System)
 - Database system
 - Billing System
 - Payment gateway

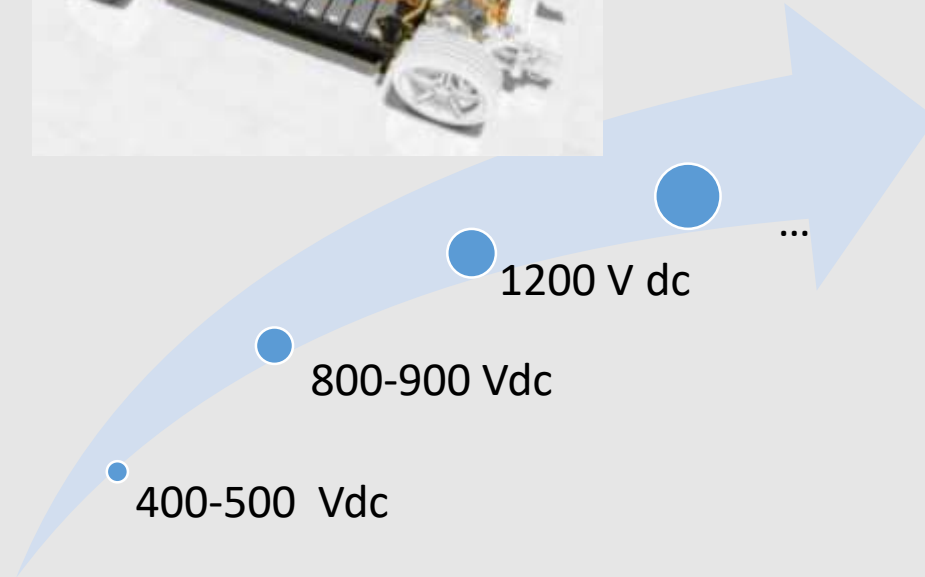
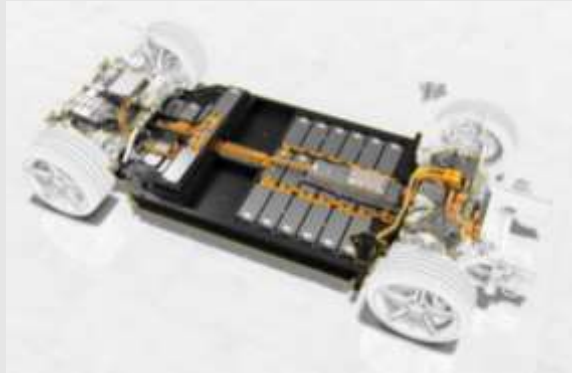


EV Charging Process



- EVSE, not just power supply device that only supplies power from a charging unit to an EV
- A Back End system (CSMS) is required to be able to operate and monitor CS. As well as required Front End (mobile apps) for interaction with users
- EVSE can only charge the EV when EVSE can communicate with the EV and find out whether the car is ready or not for charging
- The EVSE device will communicate with the CSMS to send EV charging data, charging customer data and other data

Towards Faster Charging



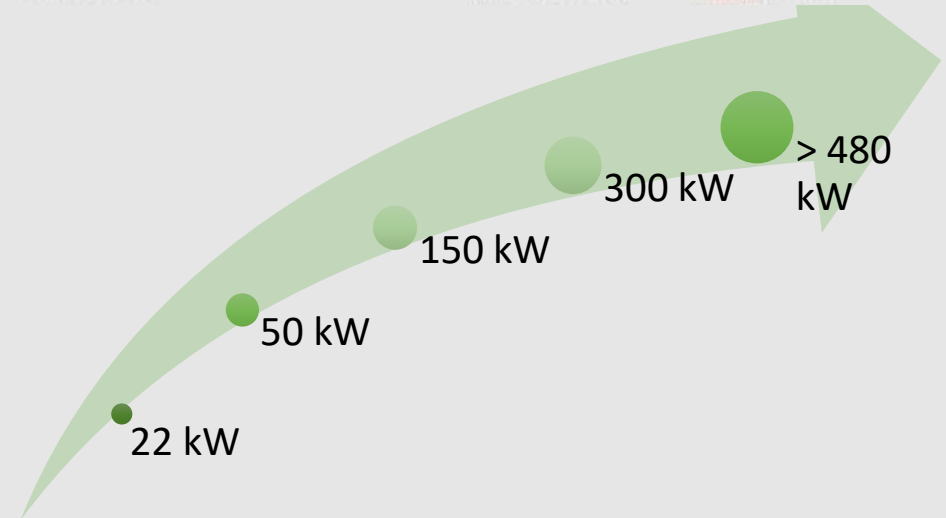
Higher EV Battery Voltage



Delta 200 kW

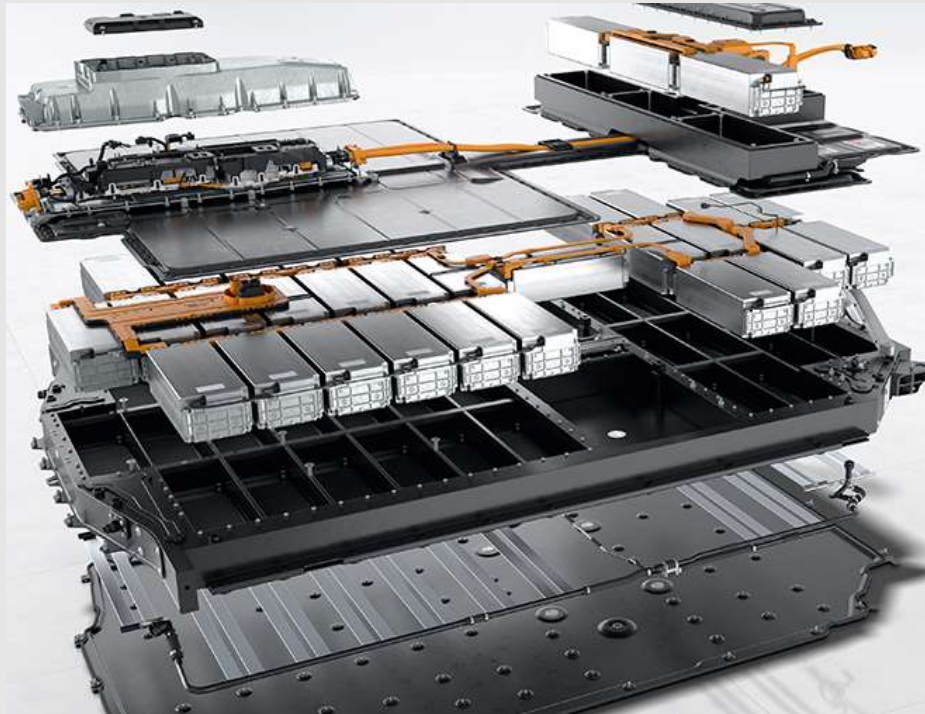
ABB terra 360 kW

Xipeng 480 kW



Higher Power of EVSE

800 V EV Architecture



- Higher Battery Pack Voltage, reduce the amount of current to the battery, less losses
- Most of new EV, now take 800 V architecture



Porsche
Taycan



Lucid Air

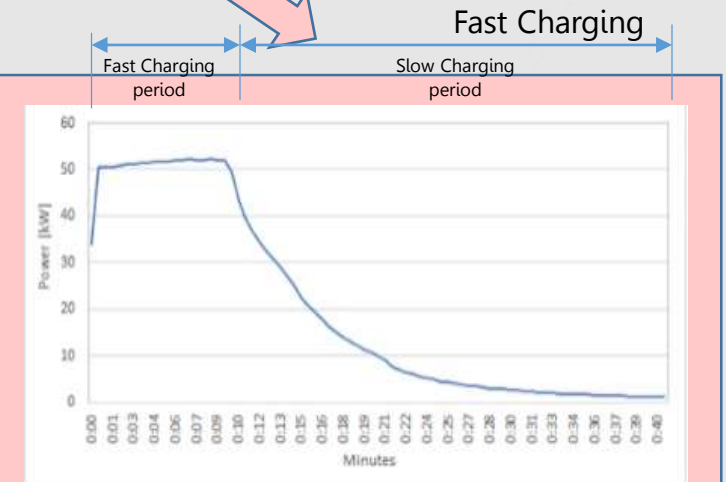
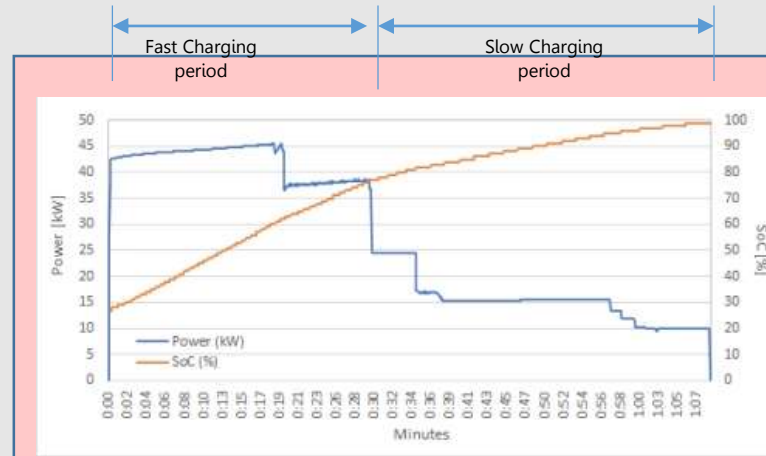
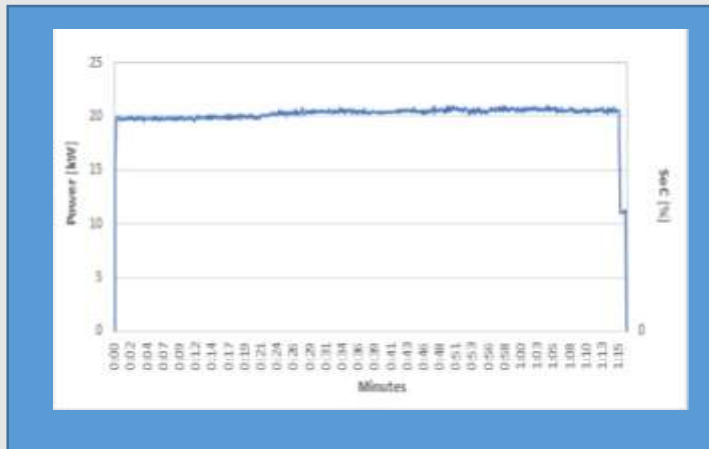
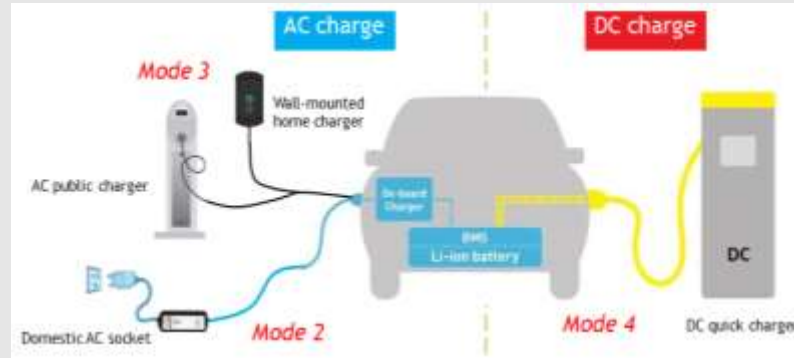


Hyundai
Ioniq-5



Rivian

Charging Profile



- Fast charging process only up to 80% SoC.
- After 80% SoC (by standard) turn into slow charging.
- Time required from SoC 80% to 100% can be longer than the initial SoC to SoC 80%
- EV BMS will control detail of the charging profile (depend on the type of EV, different charging profile even we used the same plug type)

Charging Use Cases

		Charger Type	
Stop Over Charging		FUEL STATION MODE (SPKLU)	Fast or Ultra Fast Charger
		HIGHWAY REST AREA	
Collective Parking & Charging	COMPANY FLEETS	PARK & RIDE FACILITIES	Basically Slow Charging, Fast Charging also Possible
	BUS DEPOTS		
	OTHER PUBLIC VEHICLE		
	DEPOTS		
Individual Parking & Charging	HOTELS	RECREATIONAL SITES STREET PARKING	Basically Slow Charging
	OFFICES		
	APARTEMENTS		
	HOME		Slow Charging
Private Access		Public Access	

EV Charging BRIN Research Activities



BEV Ecosystem Development

PROFESIONAL
OPTIMIS
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Peresmian EV CS BPPT 5 Des 2018



e-Taxi Blue Bird
22 Apr 2019



Perpres No.55/2019
12 Agt 2019

The issuance of Presidential Decree No. 55 of 2019 concerning the Acceleration of the Battery-Based Electric Motor Vehicle Program for Road Transportation

Pameran & Konvoi KBL
Kemenhub 31 Agt 2019



IEMS 2019 4-7 Sep 2019



MoU PLN dg 20 Stakeholder
16 Okt 2019



Karnaval Jakarta
Langit Biru 27
Okt



Peresmian SPKLU
PLN 28-29 Okt
2019



Inauguration of SPKL with
TKDN at LEN
Bandung 23
Dec 2019

Pengembangan Fast
Charging Roda 4



Charging Station
Managemen System



Kerjasama dengan
PT Pertamina Patra



AC/DC CS MT Haryono



AC/DC CS Lt Agung

IEMS 2021
24-26 November
2021



IEMS-3

BRIN will again hold the Indonesia Electric Motor Show 2022 as a forum to provide awareness and education to the public about electric vehicles BRIN will again hold the Indonesia Electric Motor Show 2022 as a forum to provide awareness and education to the public about electric vehicles

G 20

The transition to sustainable energy or green energy has become one of Indonesia's priority issues at the G20 summit, and the realization of the application of green energy includes building an electric vehicle ecosystem.

2018

2019

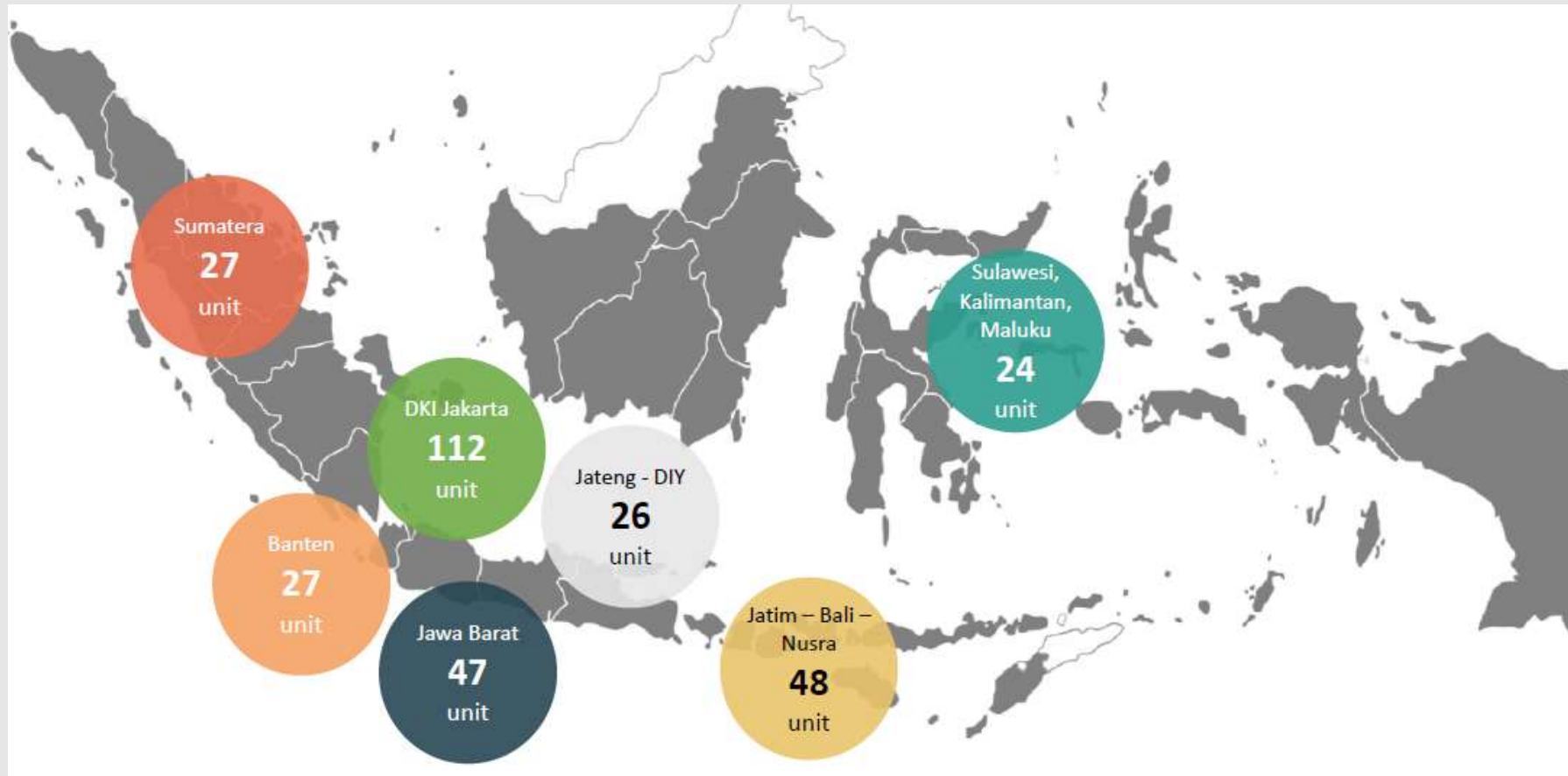
2020

2021

2022

EV Charger in Indonesia

(April 2022)

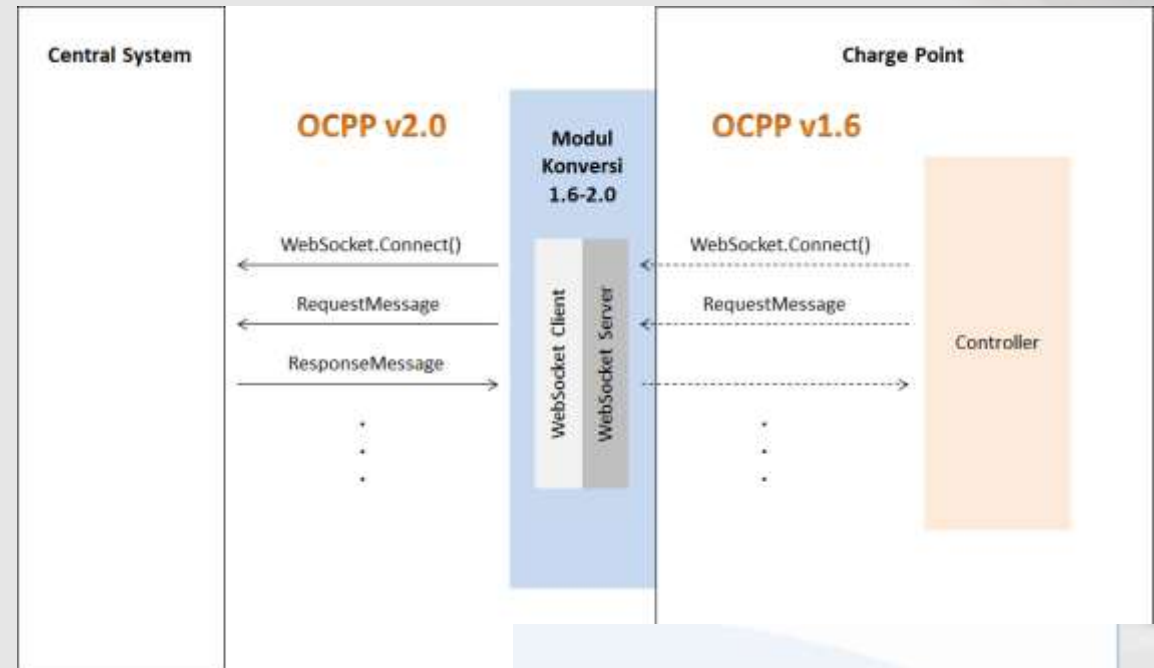


Source : Ministry of E&MR

- 311 units, consist of :
 - PLN SPKLU as majority
 - Pertamina SPKLU
 - Hotels
 - Car Distributor
- To support successful G20 meeting in Bali in November 2022 (more than 600 EVs will be used), PT PLN will add more Ultra Fast Charger, Fast Charger and also many wall chargers

OCPP 2.0 Translator

- Current Version of OCPP is 1.6, in some countries OCPP 2.0 already deployed.
- OCPP ver 2.0 will be the main version of the communication system in EV Infrastructure
- When the ver 2.0 applied in to the Central System, we need a message translator to operate EVSE with 1.6 OCPP
- BRIN has developed software to translate OCPP 1.6 messages into OCPP 2.0.
- Next, BRIN will develop hardware to be installed on the charging station



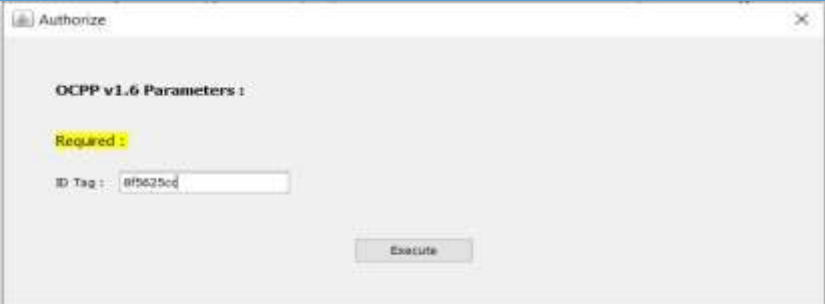
Core Profile OCPP 2.0

- Authorize
- BootNotification
- DataTransfer
- Heartbeat
- MeterValues
- RemoteStartTransaction
- RemoteStopTransaction
- TransactionEvent('Started')
- StatusNotification
- TransactionEvent('Ended')

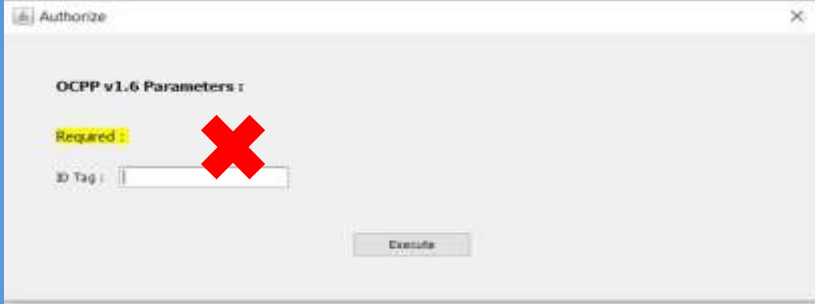
OCPP Message Parsing Tester

- All messages received by the Central System (CSMS) from the Charging Station must be checked for correctness in terms of the message's field requirement. B
- BRIN has developed a software to test whether the CSMS is able to detect correct or incorrect messages sent by the Charging Station. These messages belong to the Core Profile of OCPP (e.g. Authorize(), BootNotification(), StartTransaction(), etc.)





Positive Testing



Negative Testing

Simulator (CS) : [2,"mCP0JMnTHKw2hp7zdbWu8d4ZzB3ilfomFFxF","Authorize",{"idTag":"8f5625cc"}]
 SteVe (CSMS) : [3,"mCP0JMnTHKw2hp7zdbWu8d4ZzB3ilfomFFxF",{"idTagInfo":{"status":"Accepted",
 "expiryDate":"2022-05-17T11:23:34.735Z"}}]

Development of EV Charger Controller and Converter

System Level

Equipment Level

Modul/Component Level

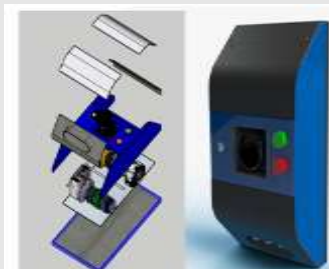


Charging Station

From System Level to Modul/Component level to increase the local content TKDN



Charger Unit

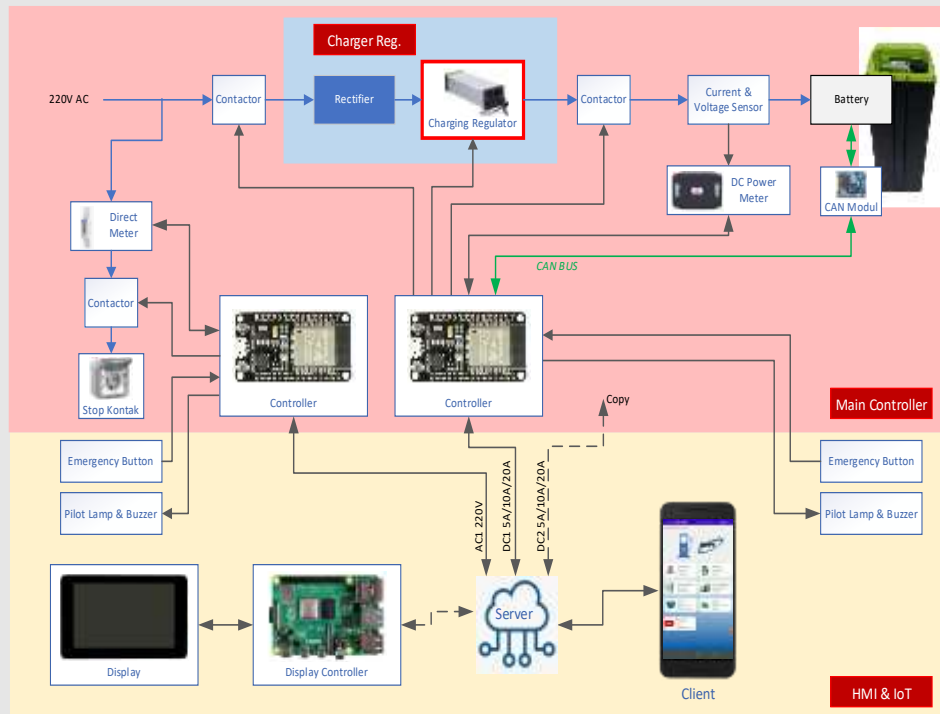


Power Converter



Charger Controller

Charger for 2-wheeler, Mobile Apps with OCPP

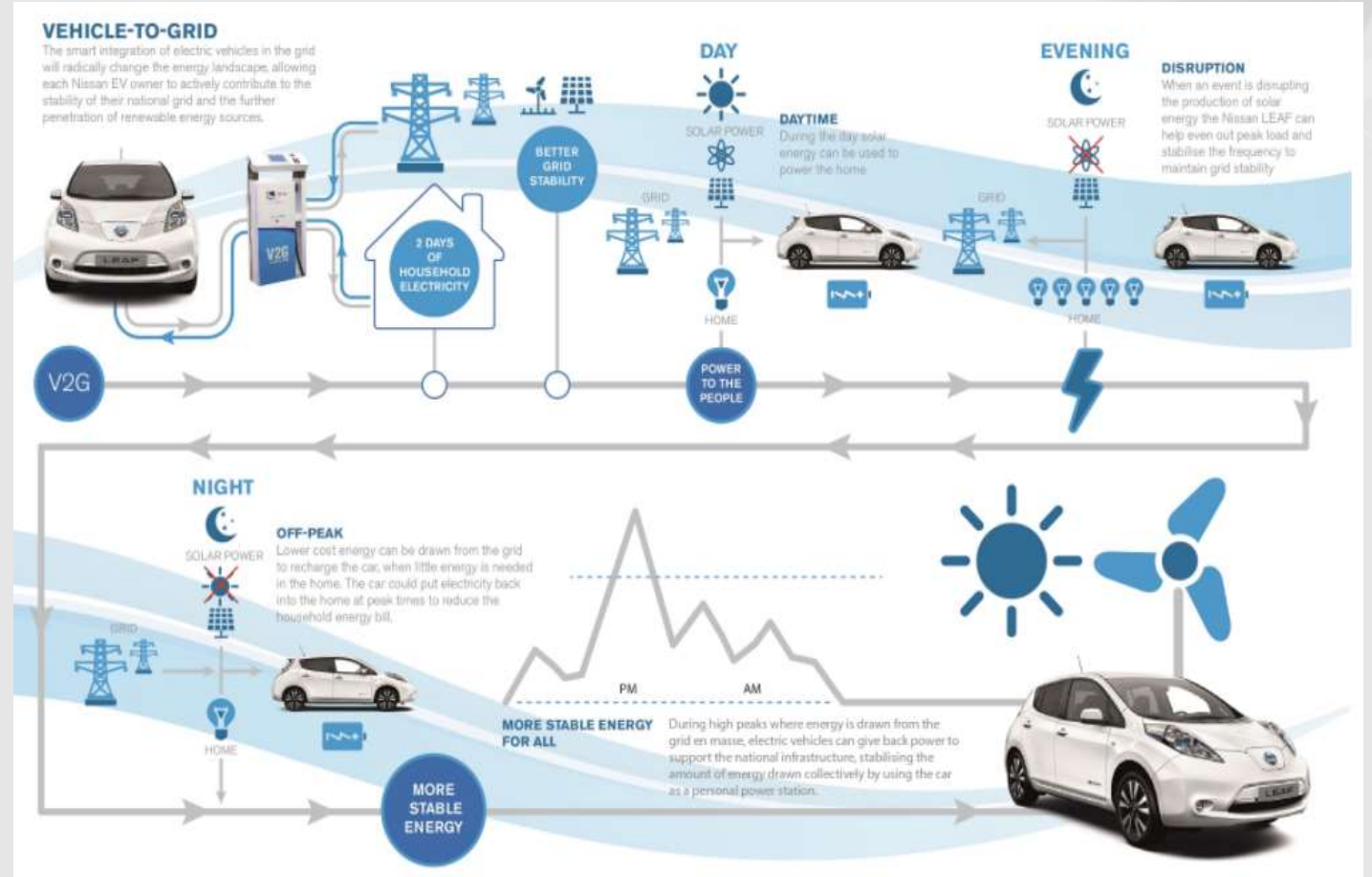


- 50 % faster with existing battery,
- It is possible to charge faster when the suitable battery for faster charger is ready

- BRIN successfully modified OCPP for 4-wheeler into 2 wheeler application software and back end system
- The system can be applied for 2-wheeler battery swab station (since there is no standard protocol for communication in the commercial battery swap station)

V2G Technology Assessment

- The Bi-directional Converter on the EV Charger allows bi-directional power flow
- EV can be Energy Storage that can supply electricity to the grid :
 - Supply electricity during an emergency with EV Battery
 - EV Battery for Grid Support
- A smart – and, where relevant, V2G – charging approach, thus smoothing peaks in the load curve, which brings advantages for EV owners, for power grids and for the whole energy system at large.
- Attractive electricity buying and selling rates, can enable EV users to participate in demand response



• Sumber : Nissan

Closing



- Number of EV users will increase, as more competitive EVs will enter the next few years
- To attract EV users, we need to increase the number of charging stations, not only fast chargers but also normal chargers in many places (low investment, low tariff)
- E-Mobility is a powerful resource, not only to decarbonize the transport sector but also to provide flexibility services to the energy system. An optimal vehicle-grid interaction will provide important environmental and economic benefits and improved system management
- BRIN will continue to work closely with stakeholders to support the development of EV Ecosystem, in order to create a better environment and the growth of the EV Industry and its supporters.



BRIN

BADAN RISET
DAN INOVASI NASIONAL

