

# Flexibility of EV charging: Use-Cases, actors and technologies

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- Panorama of the french full electric vehicles (EV) market
- Charging an EV
  - Modes

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- The plug and socket zoo
- Wallbox and Charging stations
- The french charging infrastructure
- Smart charging an EV
  - Use Case 1: Charging stations for employees within the company
    - Smart charging need: max power reduction
    - Principle and setup
  - Use Case 2: Charging commercial vehicules in depots
    - Smart charging need: energy cost reduction
    - Principle and setup
  - Use Case 3: Charging stations at home
    - Smart charging need: Autoconsumption increase
    - Principle and setup
  - Use Case 4: "Opportunist' charging stations

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Sells of full EV cars in France
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Total: ~ 276485 EV from 2010





**TOP TEN SALES – FRANCE 2020** 



Manufacturer	Model	Capacity	Autonomy	Charging power		#units	price
		kWh	Km (WLTP)	AC (kW)	DC(kW)		€
Renault	Zoé	52	395	22	0-50	37409 (33.7%)	32-38k€
Peugeot	E-208	46	340	7-11	100	16557 (14,9%)	32-34k€
Tesla	Model-3	50-75	448-580	11	250	6477 (5,8%)	44-60k€
Hyundai	Kona	40-64	289-482	7	77	5156 (4,7%)	34-46k€
Kia	E-Niro	40-64	289-455	7	77	5089 (4,6%)	38-46€
Volkswagen	ld3	45 58-77	350 424-549	11 11	50 100-125	4187 (3,8%)	34k€ 38-49k€
Nissan	Leaf	40-62	273-385	6	50-100	3395 (3,1%)	35-45k€
Peugeot	E-2008	46	320	7-11	100	2933 (2,6%)	37-40k€
DS	DS3	50	320	7-11	100	2710 (2,4%)	39-46k€
Mini	Cooper	33	234	11	50	2481 (2,2%)	38-41k€

Total: 110900 EV (6.7%)

Source : [1]





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On board charging, also called « **AC charging** » From 3kW to 22kW (and even 43kW for Zoé first generation)









#### THE PLUG AND SOCKET ZOO – MODE 2





« Green-up » : type E (CEE 7/17) Mono-p 230V



Blue: « camping » socket Mono-p 230V



Red: Industrial socket Tri-p 400V



Type 1 coupler



Type 2 coupler

Tesla coupler



![](_page_10_Picture_0.jpeg)

![](_page_11_Picture_0.jpeg)

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![](_page_11_Figure_2.jpeg)

![](_page_12_Picture_0.jpeg)

![](_page_12_Picture_1.jpeg)

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![](_page_13_Picture_0.jpeg)

![](_page_13_Picture_1.jpeg)

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(1

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## FRENCH VEHICLE CHARGING INFRASTRUCTURE

![](_page_14_Picture_1.jpeg)

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Number of station: 1 Number of Charging Points : 5 2\*22 kW AC Type 2 + 50 kW DC CHAdeMo + 50 kW DC CCS2 + 43 kW AC Type2 Installed Power ( sum (on each charging point) of the max power) : 187 kW

**DEFINITION** 

Networking for Excellence in Electric Mobility Operations

www.NEEMO-project.eu

![](_page_14_Picture_3.jpeg)

106 Avenue de Compiègne 02200 Soissons

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![](_page_14_Picture_5.jpeg)

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![](_page_15_Picture_0.jpeg)

### FRENCH VEHICLE CHARGING INFRASTRUCTURE

![](_page_15_Picture_2.jpeg)

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#### Public charging points

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	InstalledPowerCPO N		NumberO	NumberOfStation N		umberOfCP			
	MW		Units	U	nits		⊢ <u>https</u>	://www.dat	<u>a.gouv.fr/*</u> [6]
TOTAL		533	.91	9260		20475	5		
Own classification	S	Slow	Standard	Accelerated	Fast	Veryfast	Ultrafast	TOTAL	
		0-	4 4-14	14-24	24-51	51-151	>151		
Units		188	6 348	16431	1438	3 28	344	20475	https://www.data.gouv.fr/ *
%		9.2	1 1.70	80.25	7.02	0.14	1.68		
Avere classification	n l	Normal		Accelerated	Fast	Very fast			
			0-14	14-24	24-51		>51		
Units			2234	16431	1438	3	372		
In pourcents			10.91	80.25	7.02	2	1.82		– AVERE [4]
Avere Data									
Units			7093	19959	1102	2	774	28928	
%			24.52	69.00	3.81		2.68		

\*Without Tesla charging points ~500 DC very fast chargers

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Predominance of "accelerated" charging points (i.e. 22kW AC)

Few fast, very fast and ultra fast charging points

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![](_page_16_Picture_0.jpeg)

![](_page_16_Picture_1.jpeg)

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![](_page_17_Picture_0.jpeg)

 The charging points are used, during the working hours, for the vehicles of employees which commutes.

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• The charging points are generally "normal" or "accelerated" and located in the company parking lot.

![](_page_17_Picture_3.jpeg)

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![](_page_18_Figure_0.jpeg)

![](_page_19_Picture_0.jpeg)

Without max power management : 13 EV Max @ 22kW charging during 8:00 and 10:00

![](_page_19_Figure_2.jpeg)

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![](_page_20_Picture_0.jpeg)

![](_page_20_Picture_1.jpeg)

![](_page_20_Figure_2.jpeg)

![](_page_20_Picture_3.jpeg)

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![](_page_21_Picture_0.jpeg)

![](_page_21_Picture_1.jpeg)

![](_page_21_Figure_2.jpeg)

![](_page_22_Picture_0.jpeg)

![](_page_22_Picture_1.jpeg)

• The charging points are generally slow and located in the company depot.

Enedis: 1880 EV [10]

![](_page_22_Picture_4.jpeg)

La Poste : 300 establishments 7000 light commercial EV (mostly Renault Kangoo) [12]

![](_page_22_Picture_6.jpeg)

EDF / Bugey nuclear plant : 276 charging points 110 EV (Renault Zoé) [11]

![](_page_22_Picture_8.jpeg)

![](_page_22_Picture_9.jpeg)

![](_page_22_Picture_10.jpeg)

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![](_page_22_Picture_13.jpeg)

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![](_page_23_Figure_0.jpeg)

![](_page_24_Picture_0.jpeg)

Postman' round from 6AM to 12AM : 120km / day / EV (~20kWh / day / EV)

![](_page_24_Figure_2.jpeg)

![](_page_25_Figure_0.jpeg)

#### VEWORKING for Excellence in Electric Mobility Operations www.NEEMO-project.eu (Interpretended) (Int

![](_page_26_Picture_1.jpeg)

Charge management: Via Linky and an electric contactor Cost of a *n* electric contactor

![](_page_26_Figure_3.jpeg)

![](_page_27_Picture_0.jpeg)

![](_page_27_Picture_1.jpeg)

• The charging points are generally slow or accelerated and located in the garage, next the house or in the parking lot of a collective dwelling.

![](_page_27_Picture_3.jpeg)

![](_page_28_Figure_0.jpeg)

![](_page_29_Picture_0.jpeg)

![](_page_29_Picture_1.jpeg)

www.NEEMO-project.eu

kW

Electric Mobility Operations

# REDUCTION - PRINCIPLE

Cost Price (network)~15 c€/kWh Cost Price (PV) ~10c€/kWh Sell Price (PV surplus) ~ 10c€/kWh PV production : 24kW Consumption without EV: 20kWh

Period	kWh	Price (c€/kWh)	Cost c€	Sell c€
Morning	4	15	60	
MidDay	8	10	80	
MidDay (Surplus)	16	10	160	160
Evening	8	15	120	
			420	160
Total			260	

![](_page_29_Figure_6.jpeg)

# USE - CASE 3 – SMART CHARGING 3 – ENERGY COST REDUCTION

![](_page_30_Picture_1.jpeg)

WWW.NEEMO-project.eu PRINCIPLE

Networking for Excellence in Electric Mobility Operations

![](_page_30_Figure_3.jpeg)

![](_page_31_Figure_0.jpeg)

![](_page_32_Figure_0.jpeg)

![](_page_33_Picture_0.jpeg)

![](_page_33_Picture_1.jpeg)

• These charging stations are normal, accelerated or fast and are installed on public roads, in car parks of shops or shopping centers or on motorway service areas.

Owners : shops Lidl: 900 charging points

![](_page_33_Picture_4.jpeg)

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Owners : charge point operator lonity: 350 charging points (>50kW DC)

![](_page_33_Picture_6.jpeg)

**Owners : territorial collectivity** 

LaRecharge (Aix-Marseille Metropole)

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![](_page_33_Picture_9.jpeg)

![](_page_33_Picture_10.jpeg)

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174 charging points (22kW AC)

![](_page_34_Picture_0.jpeg)

![](_page_34_Picture_1.jpeg)

- Nowadays, various smart charging solutions can be setup with commercial equipments and solutions
- There exist cheap solutions but also very expensive ones
- Other « smarter » solutions exist, based on complex information systems and off-site control of the EV charges.
  - For example, smart charging of EVs @ CEA Cadarache
- To setup smart charging solutions, the charging needs of the users have to be precisely studied

![](_page_34_Picture_7.jpeg)

![](_page_35_Picture_0.jpeg)

- [1] https://www.automobile-propre.com/dossiers/chiffres-vente-immatriculations-france/
- [2] http://www.hrvojepandzic.com/wp-content/uploads/2019/09/Lecture\_4\_EVs.pdf
- [3] http://ev-institute.com/images/charged\_mag.pdf
- [4] http://www.avere-france.org/Site/Article/?article\_id=7923
- [5] https://fr.chargemap.com/

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 [6] https://www.data.gouv.fr/fr/datasets/fichier-consolide-des-bornes-de-recharge-pour-vehiculeselectriques/

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- [7] https://www.enedis.fr/sites/default/files/ENEDIS\_Rapport\_Pilotage\_de\_la\_recharge\_12-2020.pdf
- [8] https://www.tesla-mag.com/sap-labs-a-mougins-quand-la-recharge-de-vehicules-electriquesdevient-tres-intelligente/
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- [12] https://www.lemonde.fr/economie/article/2019/04/08/la-poste-numero-un-mondial-des-flottesbranchees\_5447176\_3234.html

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- [13] https://www.sma.de/fr/produits/surveillance-controle/sunny-home-manager-20.html
- [14] https://files.sma.de/downloads/EVC-10-DS-en-10.pdf

![](_page_35_Picture_15.jpeg)

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![](_page_36_Picture_0.jpeg)