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EV CHARGING STATION TREND

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ENERGY**

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EV CHARGING STATION

Commercialized Charging Stations

Types of Electric Vehicle Charging Stations

■ As defined by SAE J1772
 ■ As defined by IEC 61851-1



AC Level 1

- 120V AC, 1-phase, 12A or 16A max. continuous current



AC Level 2

- 208V-240V AC, 1-phase, $\leq 80A$ max. continuous current



DC Fast Charger

- 380V-600V AC, 3-phase input; DC output

Mode 1 (AC)

- 250V AC, 1-phase, 16A max. -OR- 480V AC, 3-phase, 16A max.
- Cord with no pilot or auxiliary connections

Mode 2 (AC)

- 250V AC, 1-phase, 32A max. -OR- 480V AC, 3-phase, 32A max.
- Cord with control pilot & shock protection

Mode 3 (AC)

- 250V AC, 1-phase, 32A max. -OR- 480V AC, 3-phase, 32A max.
- Permanently connected to AC supply with control pilot & shock protection

Mode 4 (DC)

- AC or DC input supply, cord or permanently connected, with control pilot & shock protection

- Delivers AC power from the wall socket to vehicle's on-board charger
- Typically takes 8-12 hours* to charge fully depleted battery

- Delivers AC power from the electrical supply to vehicle's on-board charger
- Typically takes 4-6 hours* to charge fully depleted battery

- Delivers DC power, bypassing the vehicle's on-board charger
- Typically provides 80% charge of fully depleted battery within 30 minutes*

https://www.littelfuse.com/~media/electronics/market_presentations/littelfuse_evi_ev_charging_infrastructure_presentation.pdf.pdf

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	Level 1			Level 2		Level 3	
	SAE J1772	IEC 61851-1		SAE J1772	IEC 61851-1	SAE J1772	IEC 61851-1
		Model 1	Model 2		Model 3		Model 4
P [kW]	1.44 – 1.92	4 – 13.3	8 – 26.6	16.4 – 19.2	8 – 26.6	120 – 350	
V [V]	120 1-ph	250 1-ph 480 3-ph	250 1-ph 480 3-ph	208-240 1-ph	250 1-ph 480 3-ph	380 – 600 3-ph	
T [h]	8 - 12			4 - 6		< 30 min	

Charging time for 100 km of BEV range	Power supply	Power	Voltage	Max. current
6–8 hours	Single phase	3.3 kW	230 V AC	16 A
3–4 hours	Single phase	7.4 kW	230 V AC	32 A
2–3 hours	Three phase	11 kW	400 V AC	16 A
1–2 hours	Three phase	22 kW	400 V AC	32 A
20–30 minutes	Three phase	43 kW	400 V AC	63 A
20–30 minutes	Direct current	50 kW	400–500 V DC	100–125 A
10 minutes	Direct current	120 kW	300–500 V DC	300–350 A

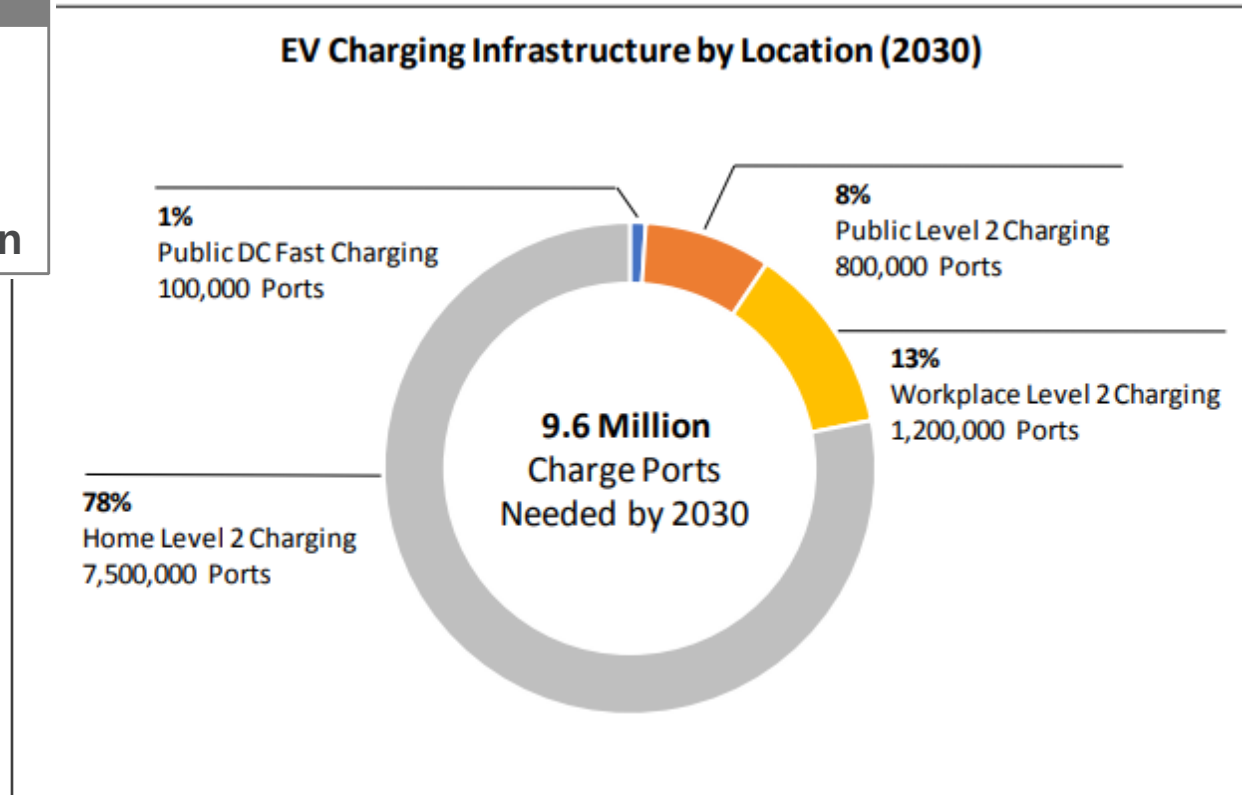
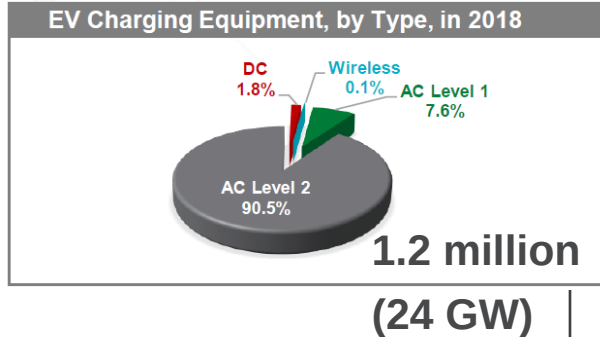
Single Phase → Three Phase → DC

Both input and output voltage go up

[1]. <http://www.ti.com/lit/wp/sway014/sway014.pdf>

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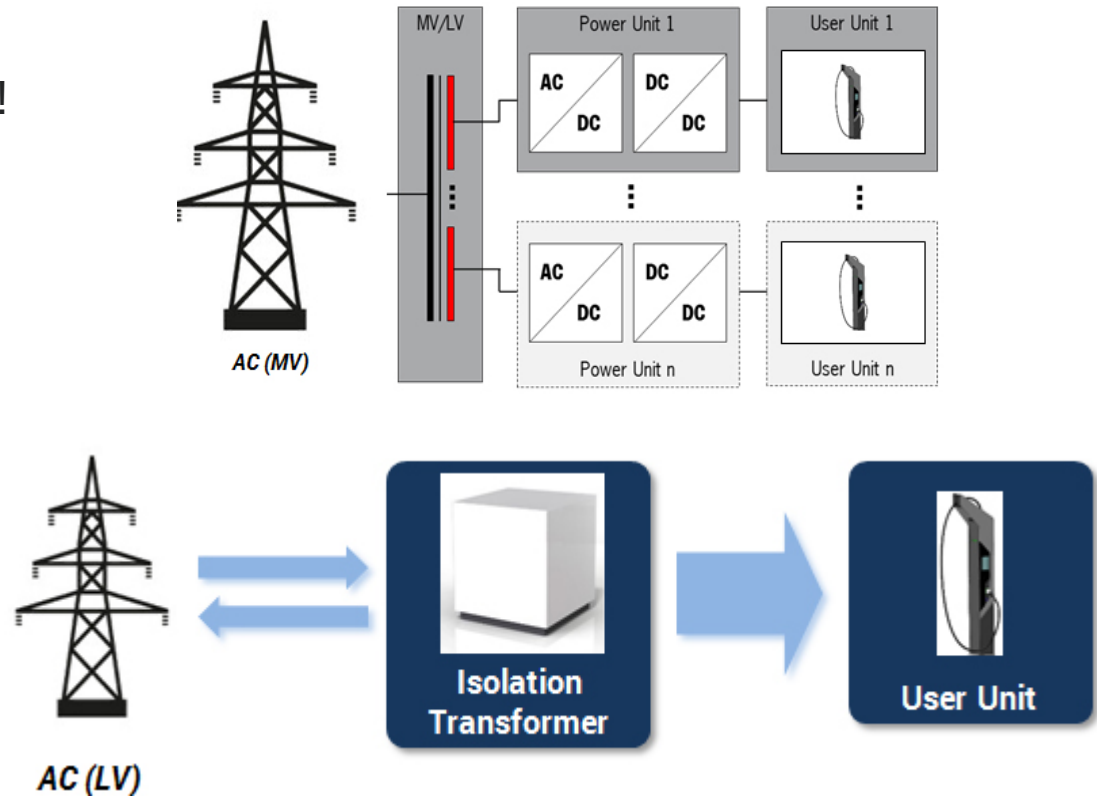
- The total EV Charging Station capacity at 2030 is 148.2 GW !

[1]. http://www.edisonfoundation.net/iei/publications/Documents/IEI_EEI%20EV%20Forecast%20Report_Nov2018.pdf

EV CHARGING STATION

Commercialized Charging Stations

- Sizing?
- Allocation?
- Impact to grid architecture!



EV CHARGING STATION

Ongoing Charging Stations – Level 4 eXtremely Fast Charging Stations (XFCs)

- XFCs is intended to charge Class 7 and Class 8 HEV [1]
- Charging Power 350 kW – 1 MW [2]

HIGH PERFORMANCE DC CHARGING SYSTEM

DC CHARGING 350A AND ABOVE FOR THE NEXT GEN ELECTRIC VEHICLE

- Compact: 1 MW/64 cubic foot
- Liquid cooled cable and power electronics
- Efficient: 98%
- Optimized for large charge parks
- Utilizes Mid Voltage Power
- Field upgradeable
- Powerful up to 500A at 950VDC
- Applications: Electric Semi Trucks, Transit Buses, Electric Class 8 Vehicles and Next Gen High Performance EV

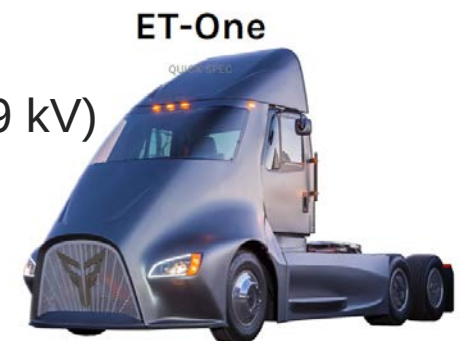
PERFORMANCE CHARACTERISTICS

- Power: 350KW-460KW
- Current Rating: 350A-500A
- DC Voltage: 950VDC

CONFIGURATIONS

- Configurable for Application
- Field upgradeable
- Dedicated or Sequential Power Delivery

- *Grid-side voltage can be MV level or LV level (13.3 kV – 69 kV)



[1]. <http://www.btcpower.com/index.php?action=high-performance-DFS>

[2]. <https://xostrucks.com/et-one/>

■ Thanks