EVSE *IS* ITS!!!

ITS WASHINGTON CONFERENCE

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SHAPING A SMARTER TRANSPORTATION EXPERIENCE™
DKSASSOCIATES.COM

AN EMPLOYEE-OWNED COMPANY

DKS

AGENDA

1 / INTRODUCTION

- DKS Electromobility

2 / EVSE 101: EV Charging Basics

- EV Charging Levels
- EV Charging Standards
- EV Charging Speed

3 / EVSE 201: Latest Trends in EV Charging

- Managed EV Charging
- New Charging Standards
- Load Management
- Bidirectional Charging & Vehicle to Grid Integration
- Curbside/right-of-way Charging
- Heavy-Duty Vehicle Electrification
- Battery-Integrated & Mobile Charging
- Automated Charging Technologies

INTRODUCTION

DKS' ELECTROMOBILITY SERVICES

Fleet Electrification

Comprehensive vehicle and charging infrastructure planning to convert light, medium, and heavy-duty vehicles to electric propulsion.

Transit Electrification

Bus electrification planning including battery charging infrastructure alternatives, electrical substation feasibility, technology planning, operations and environmental review.

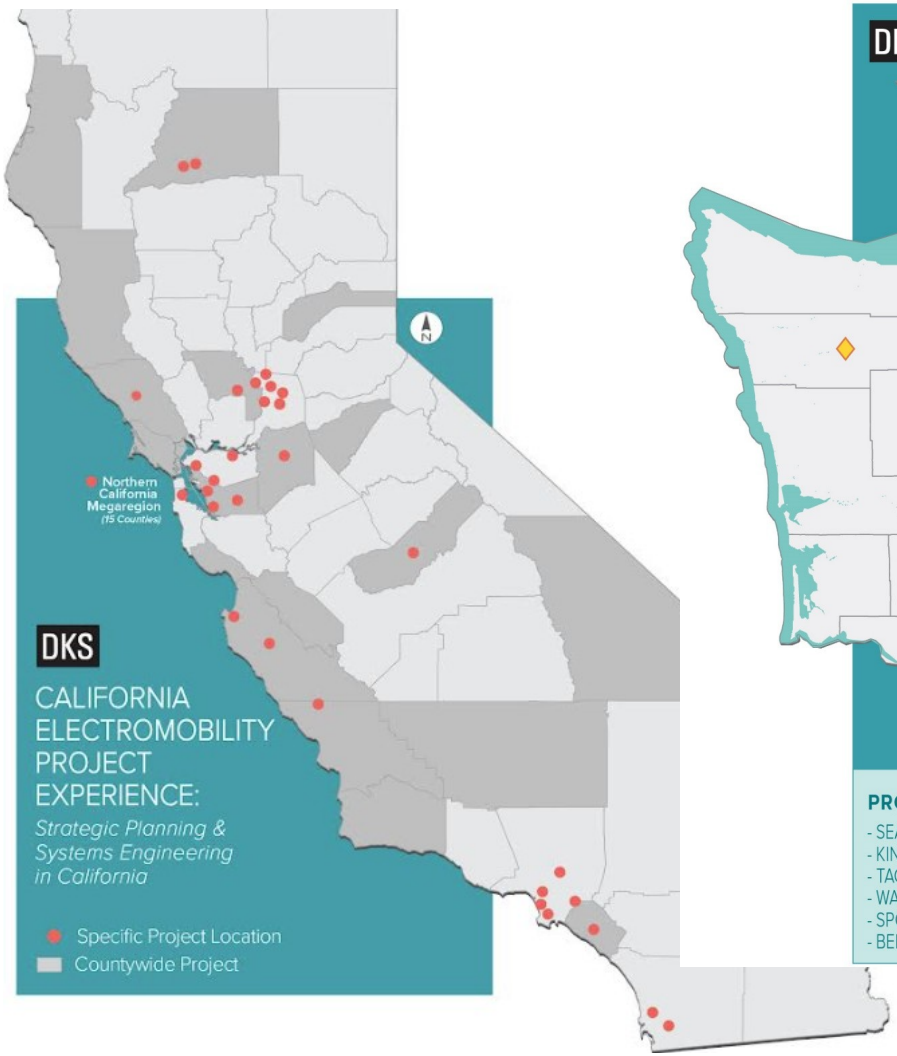
EV Charging Infrastructure Planning

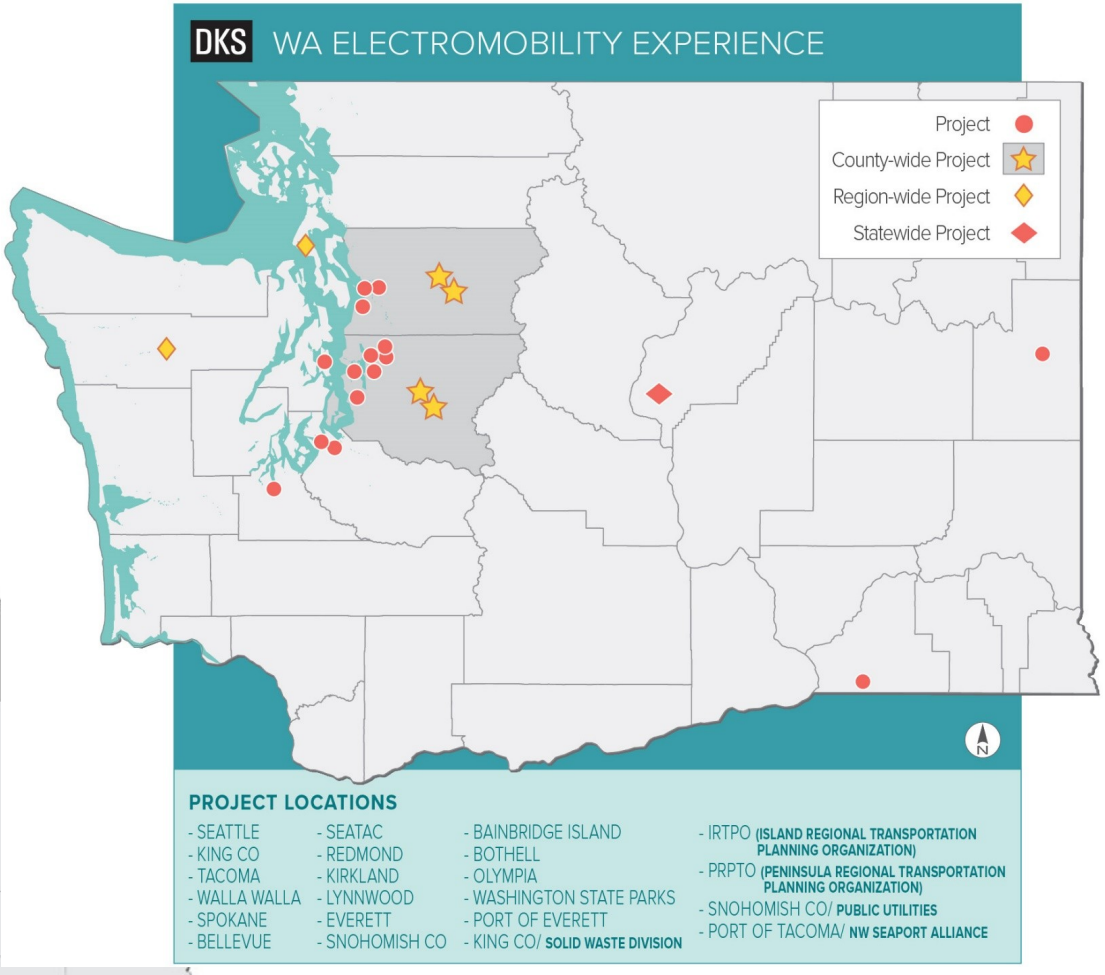
Strategic selection of sites for fleet, workplace, residential, public right-of-way, destination, and shared mobility EV charging based on travel demand expertise.

EV Charging Infrastructure Installation Design

Infrastructure design for Level 2, DC Fast, and high-power chargers including cost estimation, construction documentation, coordination with local utilities and EV charging networks.

DKS ELECTROMOBILITY EXPERIENCE IN WASHINGTON & CALIFORNIA





EVSE 101:
EV Charging Basics

EV CHARGING LEVELS

KNOW YOUR EV CHARGING STATIONS

AC Level One

VOLTAGE
120v 1-Phase AC

AMPS
12–16 Amps

CHARGING LOADS
1.4 to 1.9 KW

CHARGE TIME FOR VEHICLE
3–5 Miles of Range Per Hour

AC Level Two

VOLTAGE
208V or 240V 1-Phase AC

AMPS
12–80 Amps (Typ. 32 Amps)

CHARGING LOADS
2.5 to 19.2 kW (Typ. 7 kW)

CHARGE TIME FOR VEHICLE
10–20 Miles of Range Per Hour

DC Fast Charge

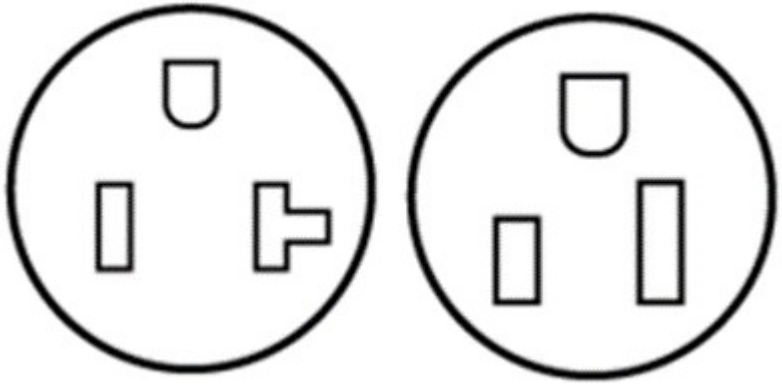
VOLTAGE
208V or 480V 3-Phase AC

AMPS
<125 Amps (Typ. 60 Amps)

CHARGING LOADS
<90 kW (Typ. 50 kW)

CHARGE TIME FOR VEHICLE
80% Charge in 20–30 Minutes

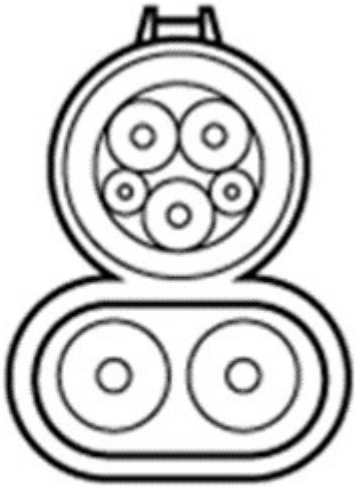
EV CHARGING STANDARDS



NEMA 5-15, NEMA 5-20

J1772

Tesla Supercharger



CCS Combo

EV CHARGING SPEEDS

EV Battery Charging Times

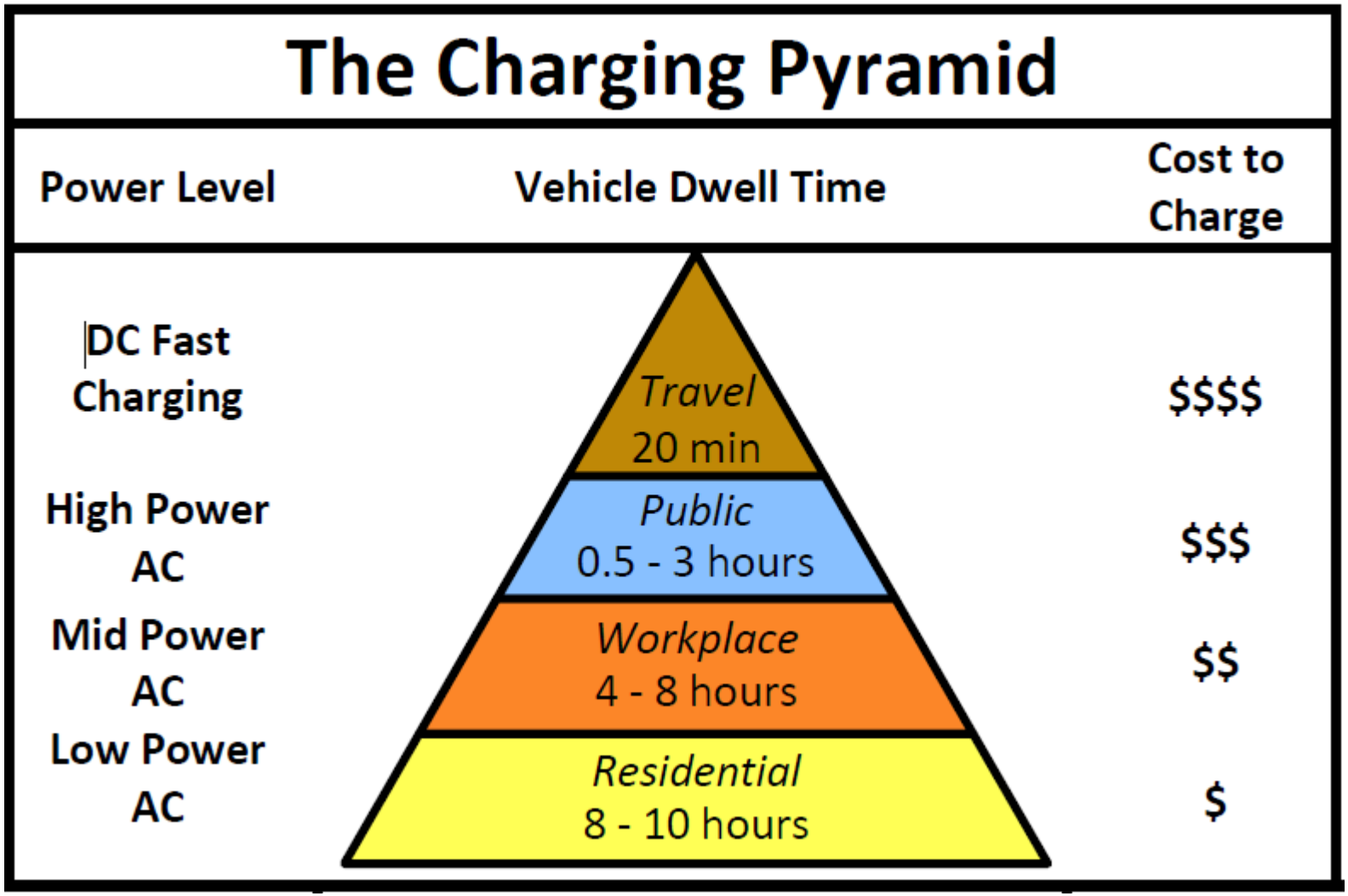
EV Vehicles	Battery Capacity (kW-h)	Acceptance Rate in kW		Time Required for Optimum (80%) Battery Charged Based on Charger Loads (h)												
				Level 1 Chargers		Level 2 Chargers						DCFC Chargers				
		AC	DC	1.4[1]	1.9[1]	3.6	6.6	7.2	9.6	12	19.2	50	100	150	175	250
Nissan Leaf	62	6.6	150	35.4	26.1	13.8	7.5	7.5	7.5	7.5	7.5	1.0	0.5	0.3	N/A	N/A
Chevrolet Bolt	66	7.2	50	37.8	27.8	14.7	10.9	7.4	7.4	7.4	7.4	1.1	N/A	N/A	N/A	N/A
Lordstown Endurance	109	11	150	62.3	45.9	24.2	13.2	12.1	9.1	9.1	9.1	1.8	0.9	0.6	N/A	N/A
Tesla Model X/S	100	11.5-17.5	250	57.1	42.1	22.2	12.1	11.1	8.3	4.7	4.7	1.6	0.8	0.5	0.5	0.3
Tesla Model Y	75	11.5	250	42.9	31.6	16.7	9.1	8.3	6.3	5.2	5.2	1.2	0.6	0.4	0.3	0.2
Ford Mach-E	98.8	10.5	150	56.5	41.6	22.0	12.0	11.0	8.2	7.5	7.5	1.6	0.8	0.5[2]	N/A	N/A
Ford E-Transit	67	11.3	100	38.3	28.3	14.9	8.2	7.5	5.6	4.7	4.7	1.1	0.6	N/A	N/A	N/A
Nissan Ariya	65	7.2	130	37.2	27.4	14.4	7.9	7.2	7.2	7.2	7.2	1.0	0.5	0.4	N/A	N/A
Volkswagen ID4	62	11	150	35.4	26.1	13.8	7.5	6.9	5.2	4.5	4.5	1.0	0.5	0.3	N/A	N/A
Ford F-150 Lightning	115	11.3	150	66.0	48.4	25.6	13.9	12.8	9.6	8.1	8.1	1.8	0.9	0.6	N/A	N/A
Hyundai Ioniq 5	58	10.9	350	33.0	24.4	12.9	7.0	6.4	4.8	4.3	4.3	0.9	0.5	0.3	0.3	0.2

1: Level 1 chargers include 16A (1.4kW) and 20A (1.9kW) breaker ampacity.

2: The base Select Ford Mustang Mach-E modal is capable of up to 115 kW of fast-charging capability, while all other Mustang Mach-E models will go to 150 kW.

00.0 = kW

EV CHARGING SPEED VS. COST



EVSE 201: Latest Trends in EV Charging

MANAGED EV CHARGING

SMART CHARGER FUNCTIONS:

- **Remote monitoring**: Drivers can remotely monitor the charge state of their EV.
- **EV battery performance**: Smart chargers can help maintain EV battery performance.
- **Schedule charging**: Drivers can schedule charging times to take advantage of lower electricity rates or to fit their lifestyle.
- **Energy load management**: Smart chargers can help balance the energy demand in the grid.
- **Grid stability**: Smart chargers can help improve grid stability.
- **Data, payment, Load Management…**

MANAGED EV CHARGING

SMART CHARGER FUNCTIONS:

- **Data Collection**: Such charging equipment is capable of recording, tracking, and analyzing charging data including:

  - ❑ Number of unique charging events
  - ❑ Average duration of each charging event
  - ❑ kilowatt hours delivered by each charger
  - ❑ Which vehicle was charged
  - ❑ Downtime at each charger, and more.

MANAGED EV CHARGING

SMART CHARGER FUNCTIONS:

- **Payment Collection:** Payment initiation options, including**:**

  - ❑ RFID or QR code
  - ❑ Credit/debit card tap or swipe
  - ❑ Apple Pay
  - ❑ Google Wallet
  - ❑ smartphone app

MANAGED EV CHARGING

SMART CHARGER FUNCTIONS:

- **Data Connectivity Options:**

  - **Ethernet**: Ideal mode of Internet, especially for DCFC requiring utility demand response.
  - **4G or if possible, 5G wireless communication**: Ideal if no Ethernet cable; most DCFCs and some L2s have SIM-card readers to allow direct connection with a cellular network
  - **Wi-Fi**: If no local Wi-Fi, then a cellular Wi-Fi router can be used.
  - **Bluetooth**: If Internet connectivity is not feasible, some EVSE can be authorized via a nearby Bluetooth device that has Internet (e.g. smartphone)
  - **NIFT**: (No Internet For Things) technology using Near-Field (NFC) Communications (Xeal)

NEW CHARGING STANDARDS

Megawatt Charging Standard (MCS)

NACS/J3400

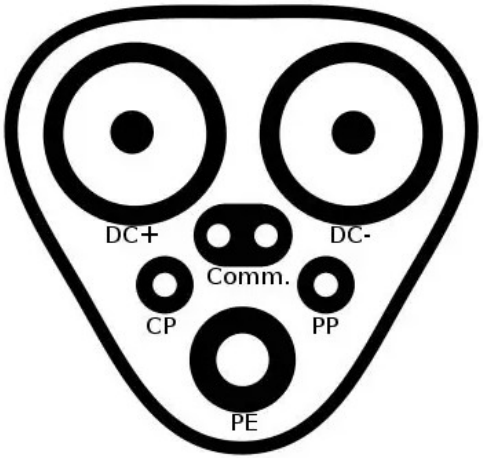


Image sources:
https://www.staubli.com/
https://thedriven.io/2022/06/27/new-standard-should-prevent-plug-war-for-megawatt-scale-electric-truck-charging/

LOAD MANAGEMENT

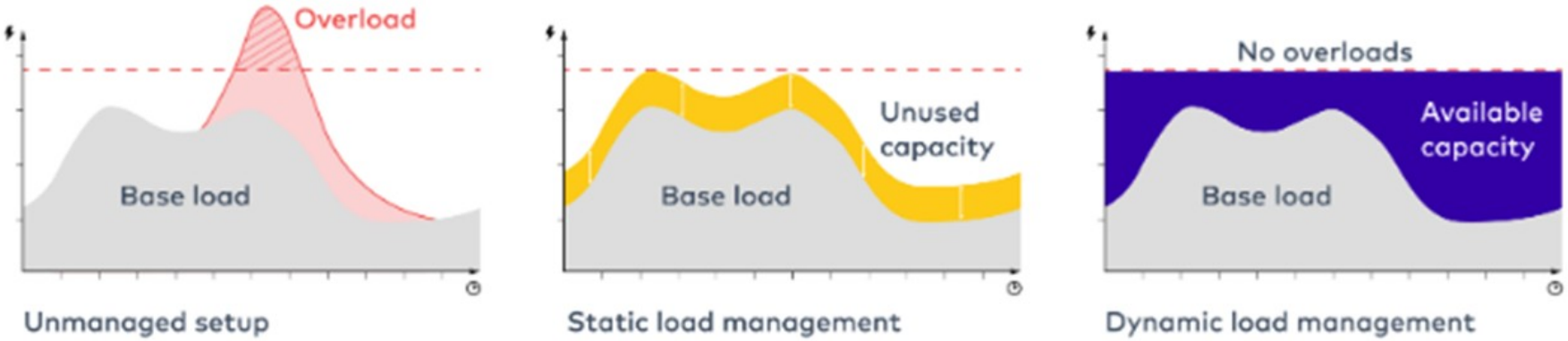


Image sources:
https://www.gridx.ai/blog/dynamic-load-management-ev-charging-regulations-uk

LOAD MANAGEMENT

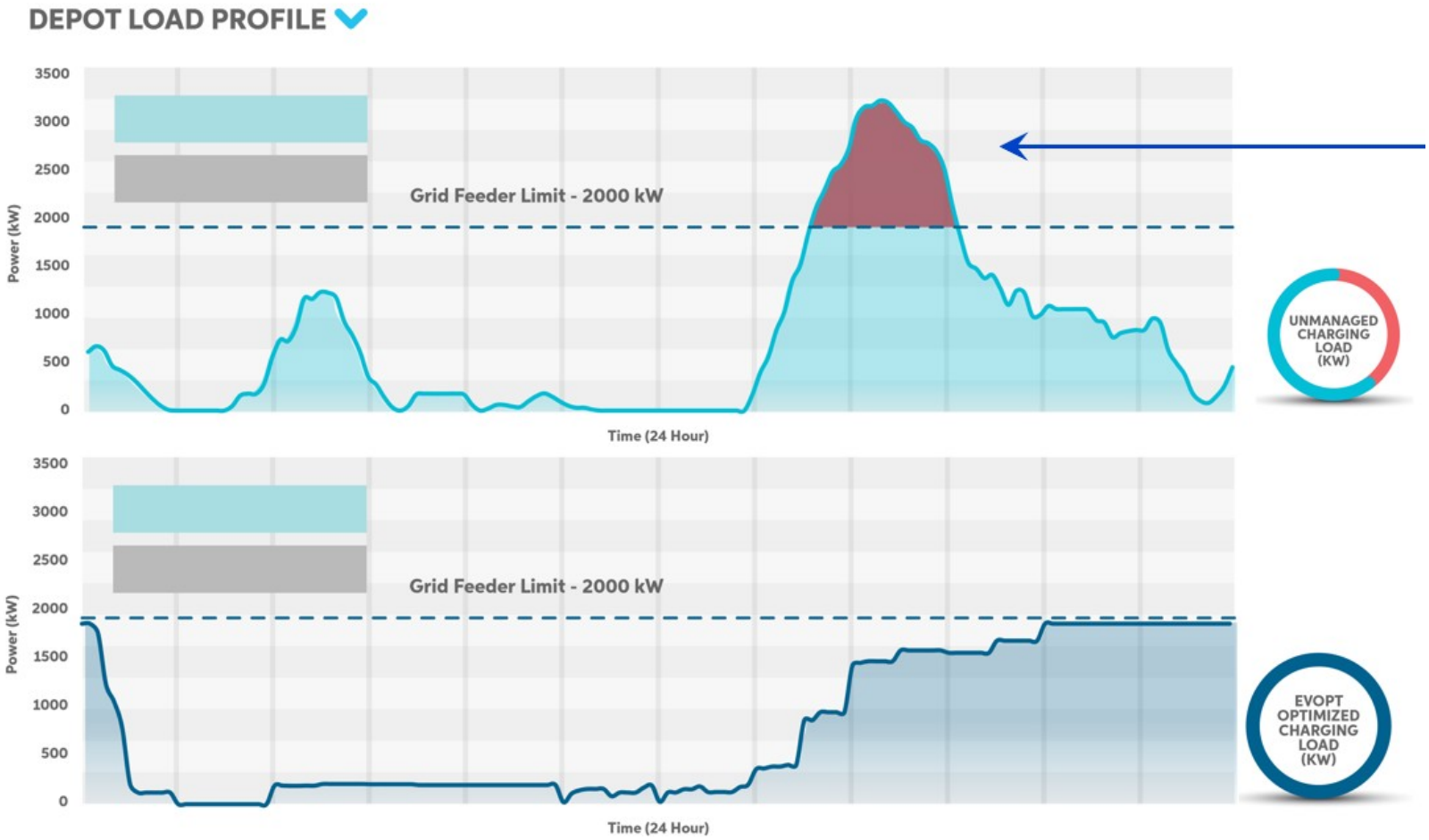
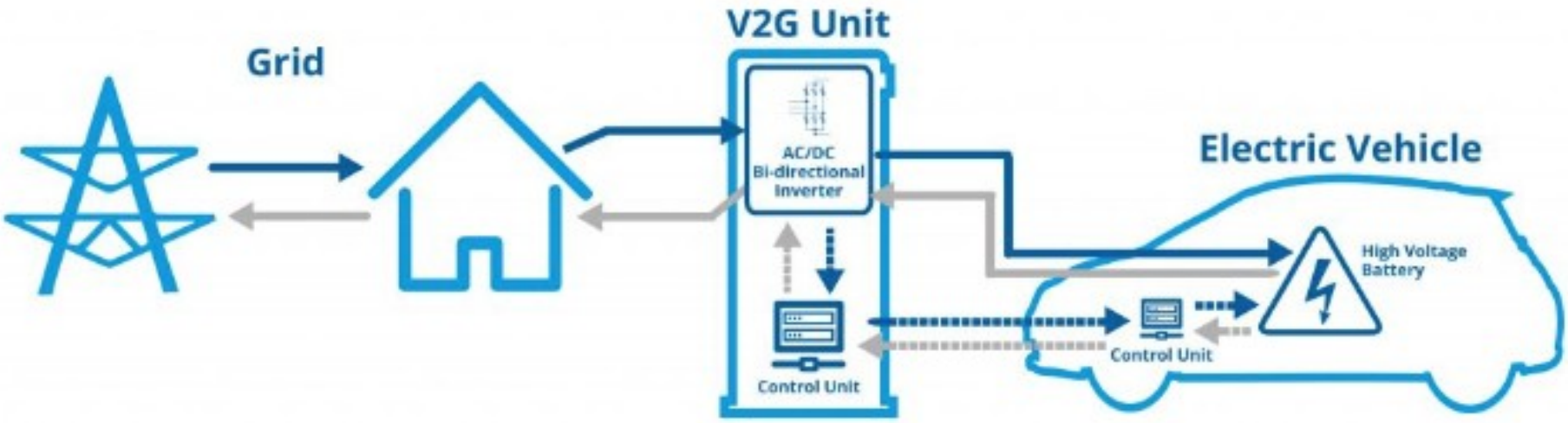


Image source:
Microgrid Labs

BIDIRECTIONAL CHARGING & VEHICLE TO GRID INTEGRATION (VGI)



- **V2B**
- **V2G (VGI & Demand Response)**
- **V2L**
- **V2V**

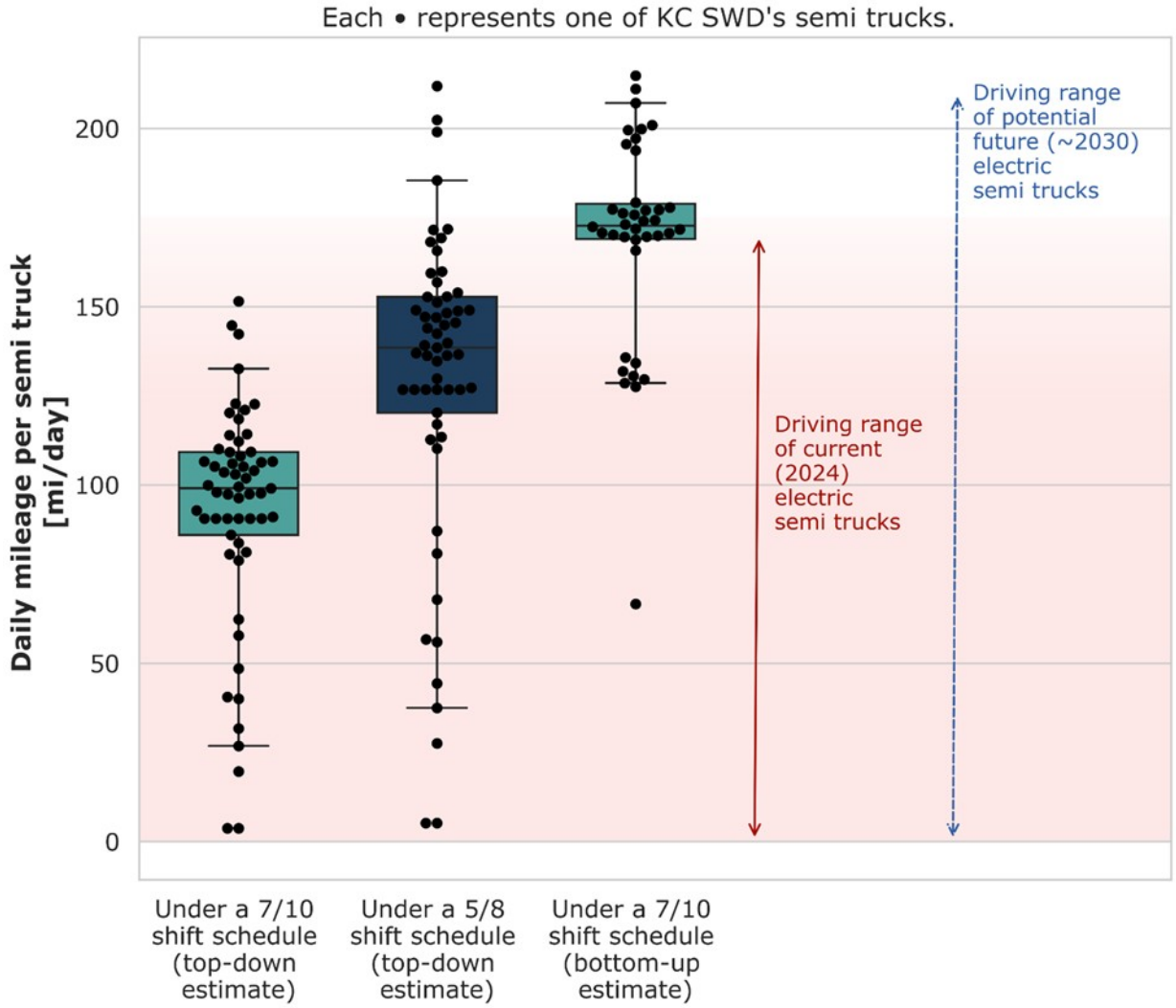
V2X

Image sources:
https://toka.energy/en/blog/vehicle-to-grid/

CURBSIDE/RIGHT-OF-WAY CHARGING

HEAVY-DUTY VEHICLE ELECTRIFICATION

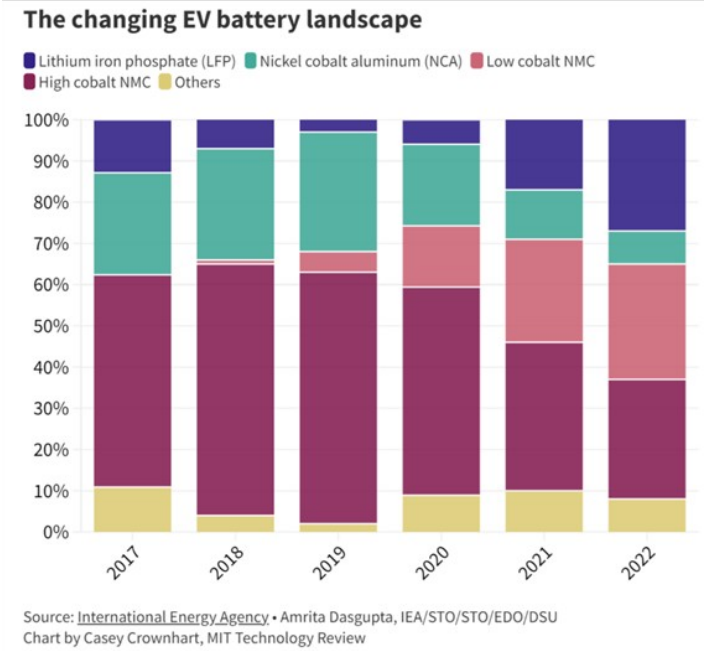
HEAVY-DUTY VEHICLE ELECTRIFICATION



BATTERY-INTEGRATED & MOBILE CHARGING

Figure 1: Volume-weighted average lithium-ion battery pack and cell price split, 2013-2023

Source: BloombergNEF. Historical prices have been updated to reflect real 2023 dollars. Weighted average survey value includes 303 data points from passenger cars, buses, commercial vehicles, and stationary storage.



Source: International Energy Agency • Amrita Dasgupta, IEA/STO/STO/EDO/DSU
Chart by Casey Crownhart, MIT Technology Review

Image sources:
https://www.evpowerpods.com/

BATTERY-INTEGRATED & MOBILE CHARGING

Mobile Charging Pod

Completely Mobile And Self-Contained, Grid Independent, DC Fast Charging Platform Designed For Travel.

Deployable Charging Pod

Rapidly Deployable And Self-Contained, Grid Independent, DC Fast Charging Platform Designed For Longer Deployment.

Truck Mounted Pod

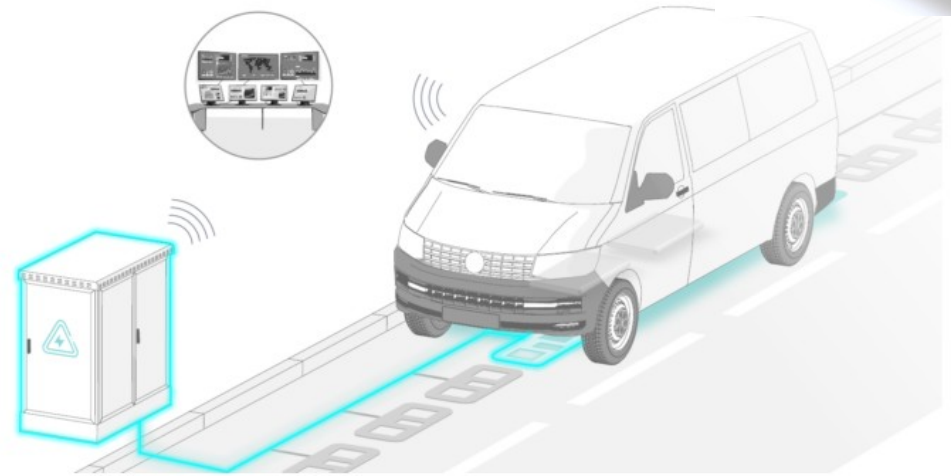
Truck Mounted And Self-Contained, Grid Independent, DC Fast Charging Platform Designed For Highly Mobile Fleets.

Image sources:
https://www.evpowerpods.com/

AUTOMATED CHARGING TECHNOLOGY

Inductive (Wireless) Charging

Image sources:
https://electreon.com/technology
https://witricity.com/
PluglessPower.com
https://www.inductev.com/



AUTOMATED CHARGING TECHNOLOGY

Robotic Charging

Image sources:
https://www.rocsys.com/
https://www.staubli.com/

AUTOMATED CHARGING TECHNOLOGY

Battery Swapping

CURRENTLY AVAILABLE EV TECHNOLOGY

2024

NEAR-TERM EV TECHNOLOGY

Vehicles and related technology that have been announced by the industry

2025-2027

MID-TERM EV TECHNOLOGY

Vehicles and related technology likely to be produced in this timeframe

2028-2034

LONG-TERM EV TECHNOLOGY

Beyond 2030 and impossible to predict

2035 + BEYOND

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QUESTIONS?

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