



NIDEC CORPORATION

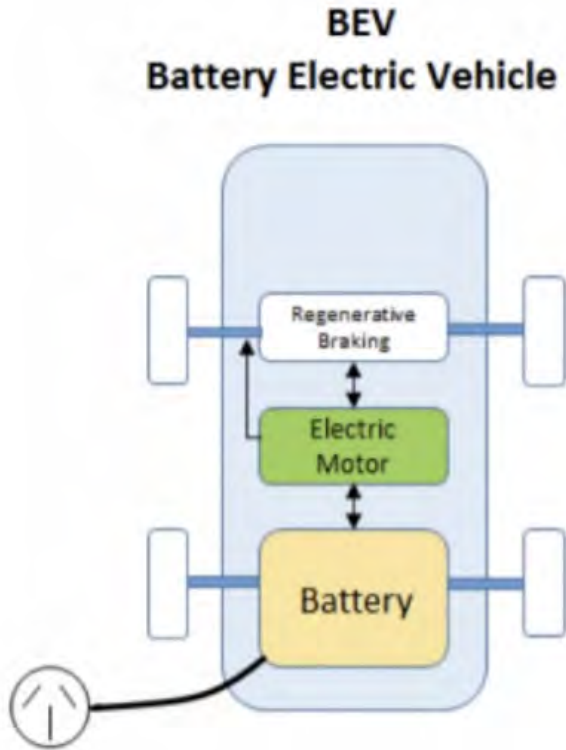
*Types of Electric Vehicle EV and
its Charging Standards in North America*

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Types of Electric Vehicles – 3 Types

BEV Battery Electric Vehicles, or BEVs. Vehicles that are powered only from an electric battery.

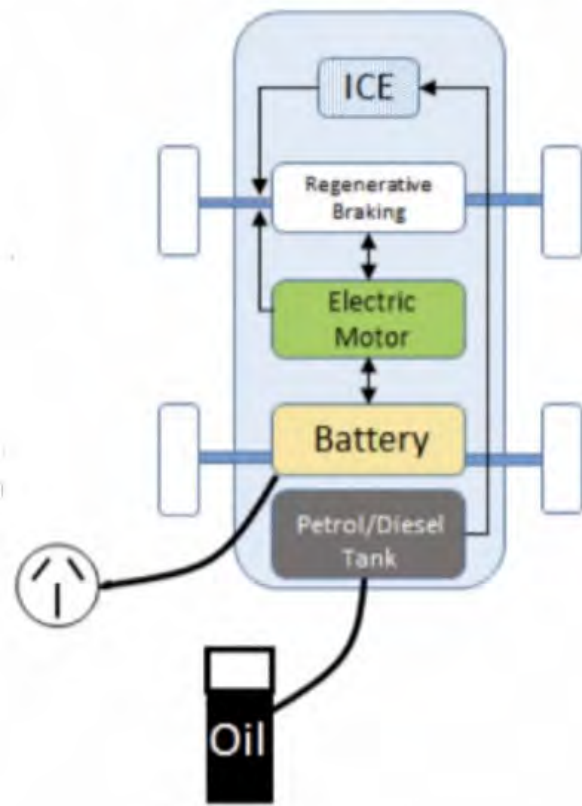


Large Battery Pack

Types of Electric Vehicles

PHEV Plugin Hybrid Electric Vehicle, Vehicles that are powered from an electric battery and an internal combustion engine.

PHEV
Plug-in Hybrid Electric Vehicle

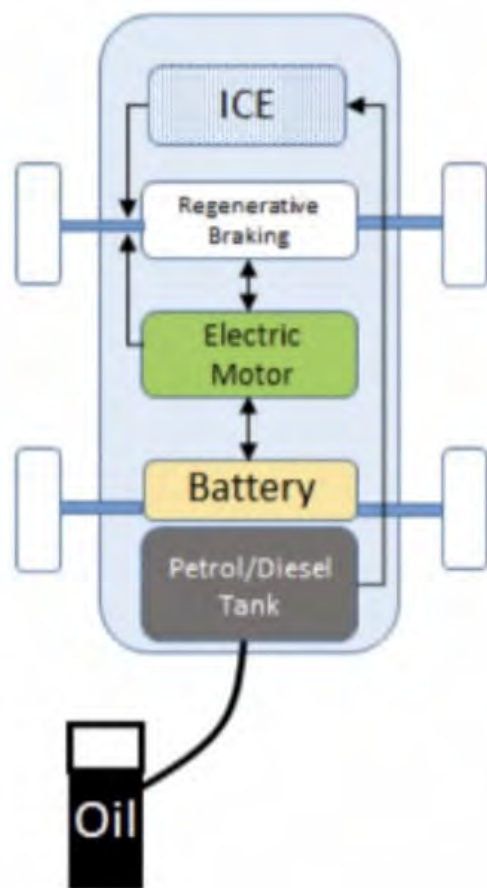


Small Battery Pack

Types of Electric Vehicles

Hybrid EV, Vehicles that are powered from an electric battery and an internal combustion engine, but the battery is charged only charged by regenerative breaking.

HEV
Hybrid Electric Vehicle



Smallest Battery Pack

EV Powertrain

Power Conversion: Electric Motor



Mechanic Energy
(Motion, Speed of
Wheels)

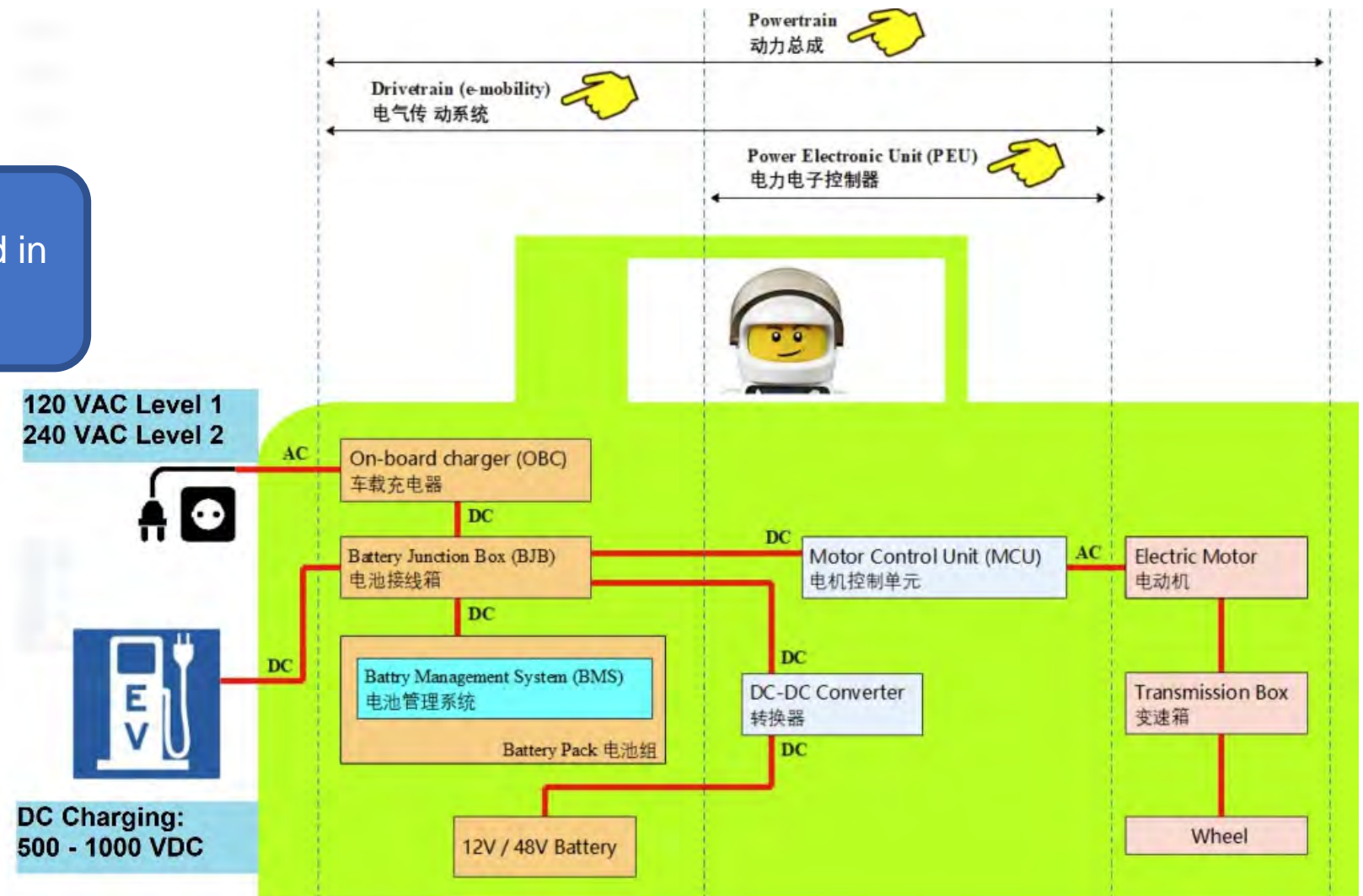
**Electric Energy (Stored in
Battery Pack)**

BEV: 50-100 kWh; PHEV: 10-15 kWh; Hybrid: 0 kWh

Energy equivalence: 1 gal gasoline = 33.7 kWh

BEV: 25 kWh/100 mi or 3-4 mi/kWh. 12,000mi/year => 3,000-4,000 kWh. Cost: \$300 – \$600 of electricity per year

ICE car 25 mi/gal. \$4.6/gal. Cost: \$2200/y



Charging Speed, Duration of charging in minutes or hours?

How fast to charge an EV?

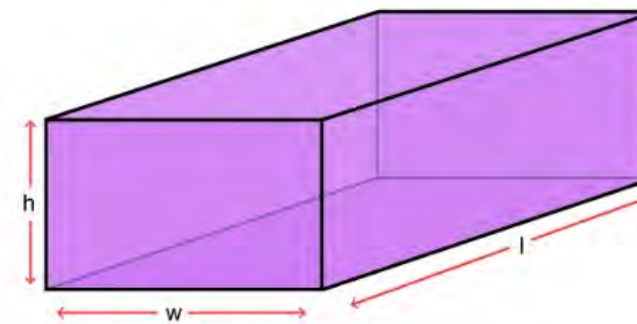
- Battery Capacity (kWh)
- Charging Power of Charger (kW)
- Battery BMS receiving power or actual charging power (kW)

Battery Capacity or Size, Unit: kWh



Volume of a Rectangular Prism

MATH MONKS



Formula: $\text{Volume (V)} = l \times w \times h$

here, l = length, w = width, h = height

Volume (V) = Cross Area x Length

Electric Charging power:

Cross area -> P in kW

Length -> Hours in h

Battery Capacity: kWh

Time to charge:

$$t = \text{Volume} / P$$

$$t = 50 \text{ kWh} / 50 \text{ kW} = 1 \text{ h}$$

$$t = 100 \text{ kWh} / 200 \text{ kW} = 0.5 \text{ h}$$

$$t = 42 \text{ kWh} / 7 \text{ kW} = 6 \text{ h}$$

Thinking using a garden hose to fill a water tank:

Bigger the pipe, Shorter the time needed.

Charging Power = min (Charger Power, Battery receiving Power)

Types of Electric Charging – AC or DC charging

AC Charging

- ❖ Level 1 (L1): Voltage 110 – 120VAC; Current 16A, Charging power, 1.76 kW
- ❖ Level 2 (L2): Voltage 208-240VAC; Current 30-40A, Charging power, 7.6 – 9.6 kW
- ❖ Charger Connector J1772 for North America. Type 2 for EU. Electrical signal is the same, it differs only in shape.
- ❖ On Board Charger (OBC)
 - Convert AC power to DC power to charge battery
 - Bottleneck of EV charging
 - On the vehicle, Can't be too much weight
- ❖ Typical Household Grid Power
 - 125-200 A panel.
 - 40 A accounts of 20-30%



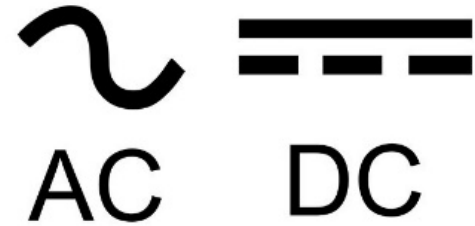
Safe EV Charger Level 2 | Smart Charging Station 8.8KW/40A, Level 2, ev Charger 100-250 Volt, with NEMA 14-50 Plugs, Cable Size 20 Feet (6.1M), Compatible...



DC Fast Charging

DC Charging

❖ DC Voltage



❖ Bypassing OBC Directly to Battery Pack

❖ Battery BMS and Voltage Platform

- Battery Management System (BMS)
- 480VDC and 800VDC

❖ DC Charging Power

- Power = V (v) x I (A) kW
- Typical EV Charger 120-360 kW

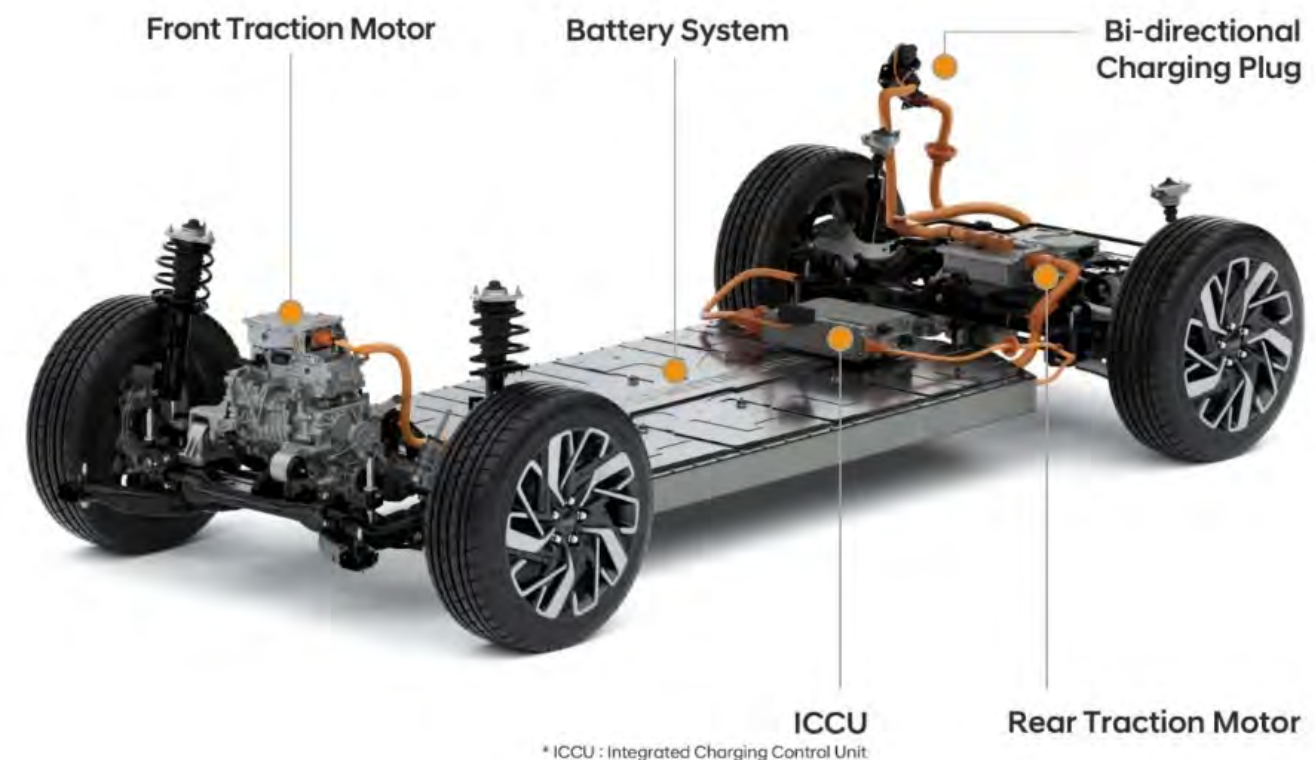
❖ Major Charging Network

- Tesla Supercharger Network
- Electrify America
- EVgo
- ChargePoint
- Greenlots

❖ APP PlugShare



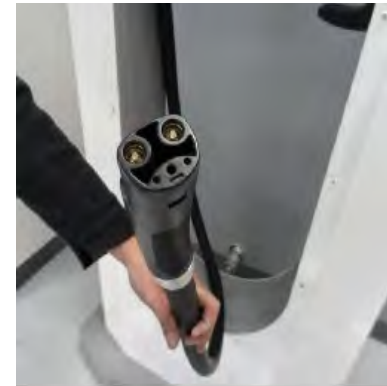
6.6 kW OBC Liquid cooled EV Charger. AC to DC



Charging Connectors

Tesla Connector

One Type, both for AC and DC



CCS1 (Combo Charge System)

1 North Am. 2 for EU only for DC



CHAdeMO EV Connector

Only for DC – phasing out



AC J-1772 Connector 250VAC/40A



CHARGED FUTURE

DC Fast Charging Basics

	CCS	ChaDeMO	Tesla
Plug/Connector Types			
Range Added Per Minute	2-6 Miles	2 Miles	5-9 Miles
Charging Duration to 80%	25-60 Minutes	60 Minutes	20-40 Minutes

Charging Sites



EA BMW iX charging power @ 138kW

V2G (Vehicle to Grid), V2H, V2L and V2X

What is V2G?

To send the stored energy back to grid, home, any other load.

How ?

To use an inverter. From DC power to AC power.

Examples: Ford F-150 Lightning Truck



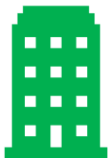
F-150 Home Integration System @ 9.6kW only \$3895



A Leading Global Manufacturer of Electric Motors and Controls



Founded in
1973



HQ: Kyoto



\$17.4B*
2021 GROUP
TURNOVER



\$44.7B
Market
Capitalization
(as of 4/1/2022)

Mr. Nagamori, Founder & CEO



Nidec Competes in *Everything That Spins and Moves*

INFORMATION TECHNOLOGY

PCs / Servers
Data Center Cloud
Smartphones
Haptics / HMI
Consumer Electronics
Digital Recorders / Cameras...

VEHICLES

EV Traction Drives
(LSEV, Golf Carts, Utility, Passenger,
Material Handling, Bus, Off Road Heavy...)
Passenger Car Peripherals & Electronics
(ADAS, Power Steering, Braking, Oil/Water
Pump, Sunroof, Windows, Seats, HVAC...)

ROBOTICS

Factory Automation
Automated Guided
Vehicles
Power Assist Suits
Personal Mobility
Telepresence Robot
Drones...

POWER GENERATION

Electric Generators
Nuclear Energy
Renewable Energy
(Solar, Wind, Hydro...)
Battery Energy Storage
Systems
Grid Stability...

APPLIANCES

Washers
Dryers
Dishwashers
Refrigerators
Fans
Air
Conditioners...

INDUSTRY

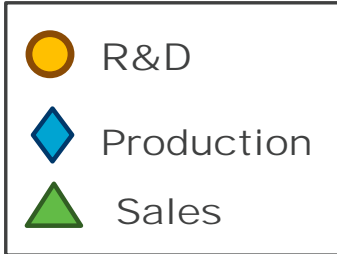
Automation Systems
Conveyors
Compressors
Fans
Pumps...

Nidec Global Footprint


300+


40+

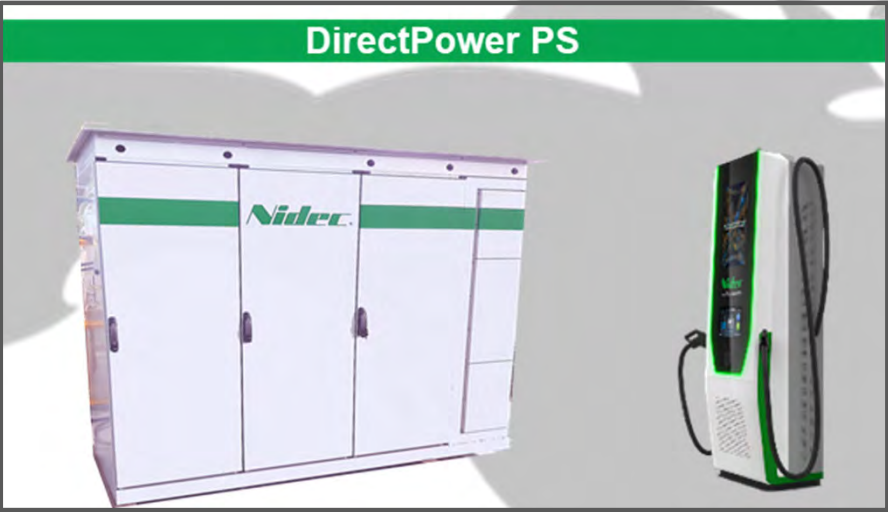

145,000



Nidec Industrial Solutions: EV Charging Infrastructure



Robust, high-performance, dependable EVCI
Equipment for the United States
Designed, Built, and Serviced in the US



Our Focus:

- AVAILABILITY
- FLEXIBILITY
- DEPENDABILITY
- VALUE

Jeffrey Lehman, PE
Director, EV Charging Infrastructure

Nidec EVSE Portfolio: DC EV Charging

DirectPowerPS



Power Conversion Unit
50kW Grid Input
Battery Energy Storage
(optional)



Dispenser
Up to 320kW Output
Dynamic Power Sharing

DirectPower120

DirectPower360



All-in-One EV Chargers
Up to 360kW Output
Dynamic Power Sharing

Ideal For:

- Electrical capacity constraints (facility or grid)
- Facility or fleet resilience
- Legacy corridor 50kW DCFC replace-in-place

Ideal For:

- Locations with no electrical capacity constraints
- Greenfield charging projects
- Corridor, fleet depot, multi-family, workplace:
Minimum wait times, maximum load management flexibility



Q & A.

The End.

Thank you!