

Electric vehicles

GLOBAL AND NATIONAL ENERGY SCENARIO. (1 hours)

INTRODUCTION TO ENERGY SOURCES (2 hours)

Classification of Energy Sources in terms of Primary and Secondary Sources, Commercial and Non Commercial Sources of Energy; Renewable and Fossil based Sources of Energy;

INTRODUCTION TO FUELS AND ITS PROPERTIES (1 hours)

INTRODUCTION TO VARIOUS ENERGY CONVERSION SYSTEMS (6 hours)

like Power Plant, Pump, Refrigerator, Air Conditioner, Internal Combustion Engine, Solar PV Cell, Solar Water Heating System, Biogas Plant, Wind Turbine System general functioning including their normal rating specifications.

ASPECTS OF ENERGY CONSERVATION AND MANAGEMENT (4 hours)

Energy Conservation Act, Energy Policy of Company; Need for Energy Standards and Labelling; Energy Building Codes.

ENERGY STORAGE IN BATTERIES (2 hours)

Type of batteries; Electric Vehicles

Introduction

- An electric car is an alternative fuel automobile that uses electric motors and motor controllers for propulsion, in place of more common propulsion methods such as the internal combustion engine (ICE).
- Electric cars are specifically a variety of electric vehicle intended for use as a road-going automobile. Electric cars are commonly powered by on-board battery packs, and as such are battery electric vehicles (BEVs).
- Electric cars currently enjoy relative popularity in countries around the world for their eco-friendly nature.

History of EV's

□ 1830's

- Battery electric vehicle invented by Thomas Davenport, Robert Anderson, others - using non-rechargeable batteries
- Davenport's car holds all vehicle land speed records until ~1900

□ 1890's

- EV's outsold gas cars 10 to 1, Oldsmobile and Studebaker started as EV companies

□ 1904

- First speeding ticket, issued to driver of an EV
- Krieger Company builds first hybrid vehicle

□ 1910's

- Mass-produced Ford cars undercut hand-built EV's
- EV's persist as status symbols and utility vehicles until Great Depression



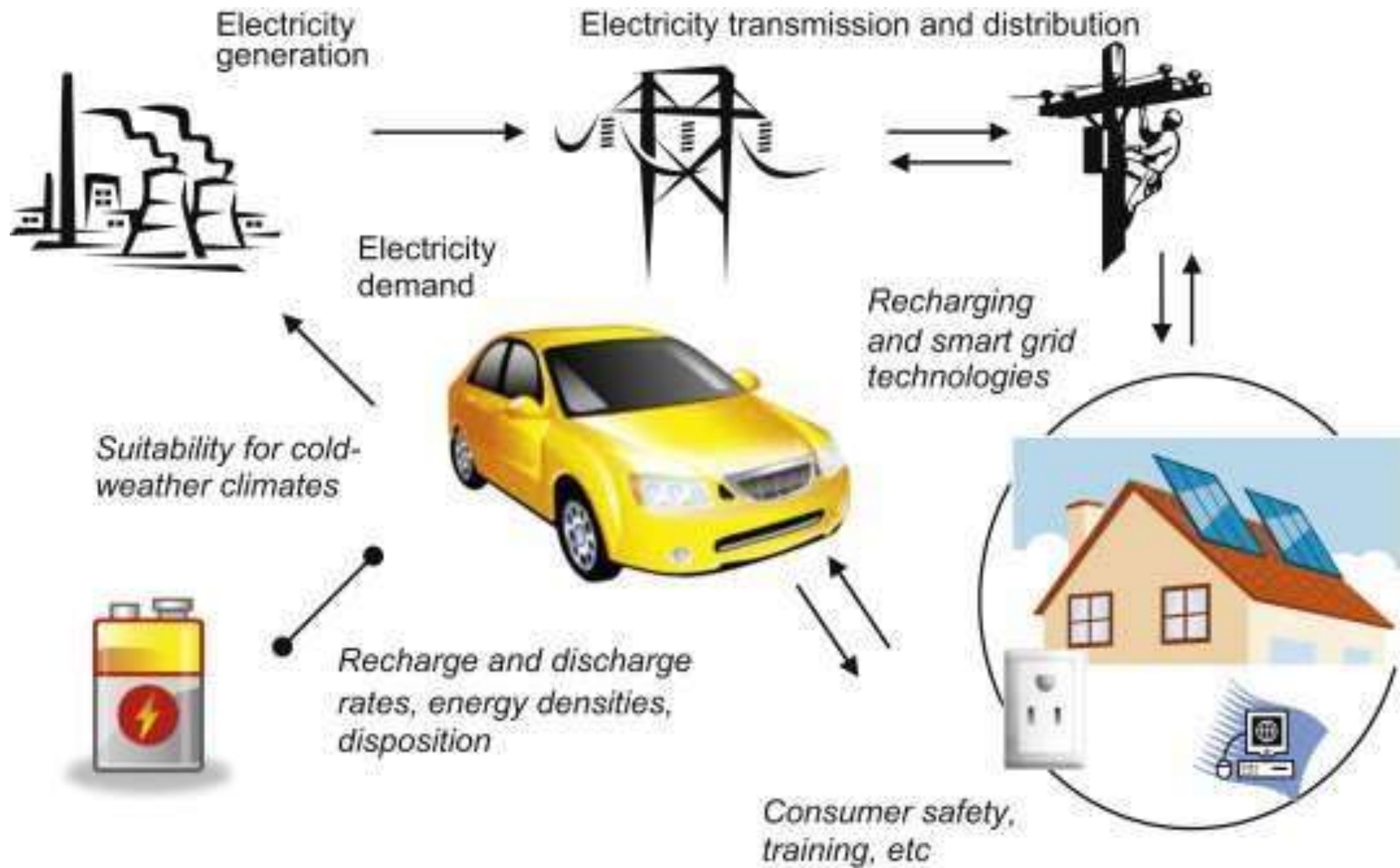
Figure 52. Ford Electric Car No. 2. (From the collections of Henry Ford Museum & Greenfield Village, neg. 188.72082)

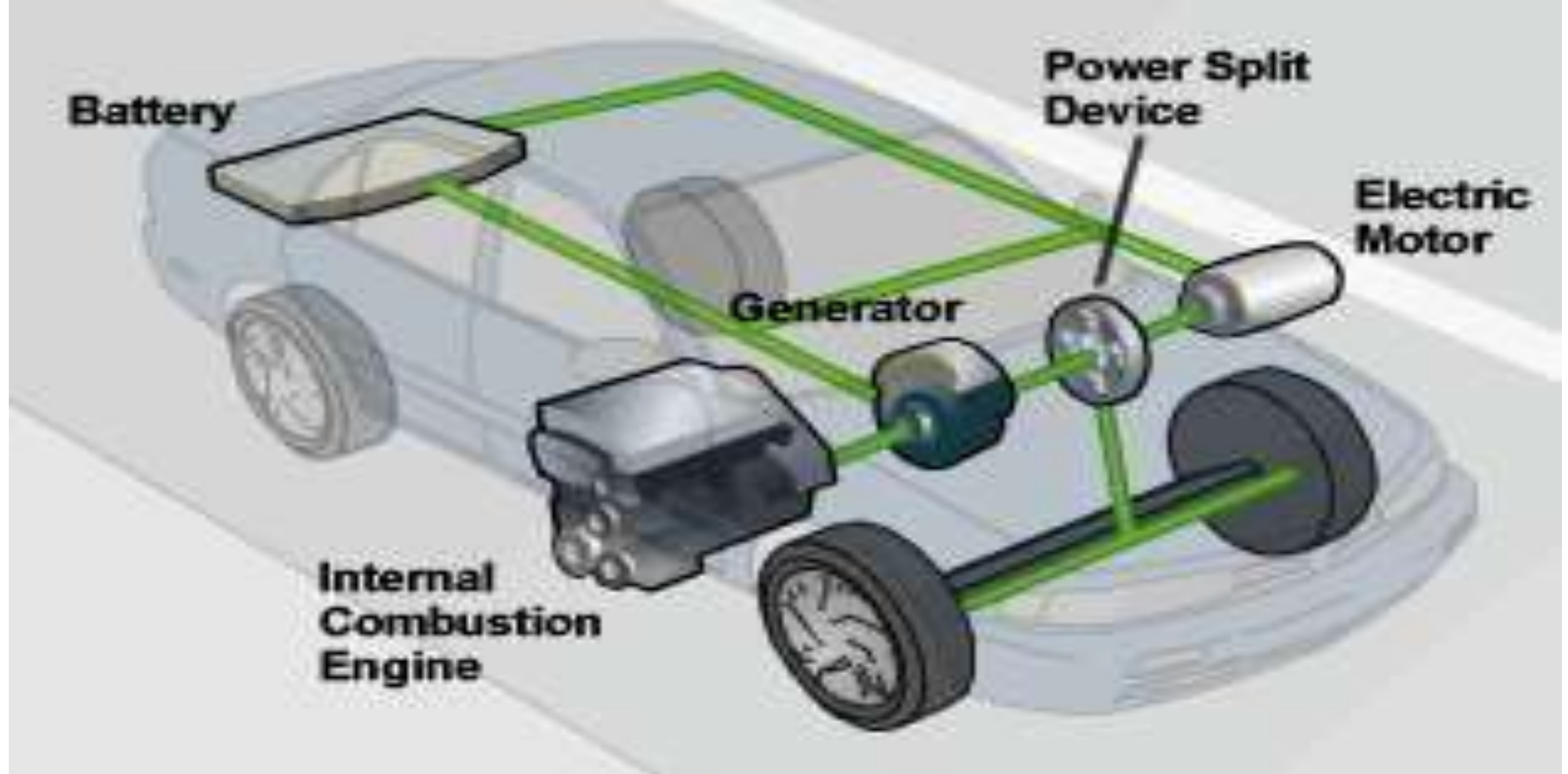
Ford Electric #2



Detroit Electric

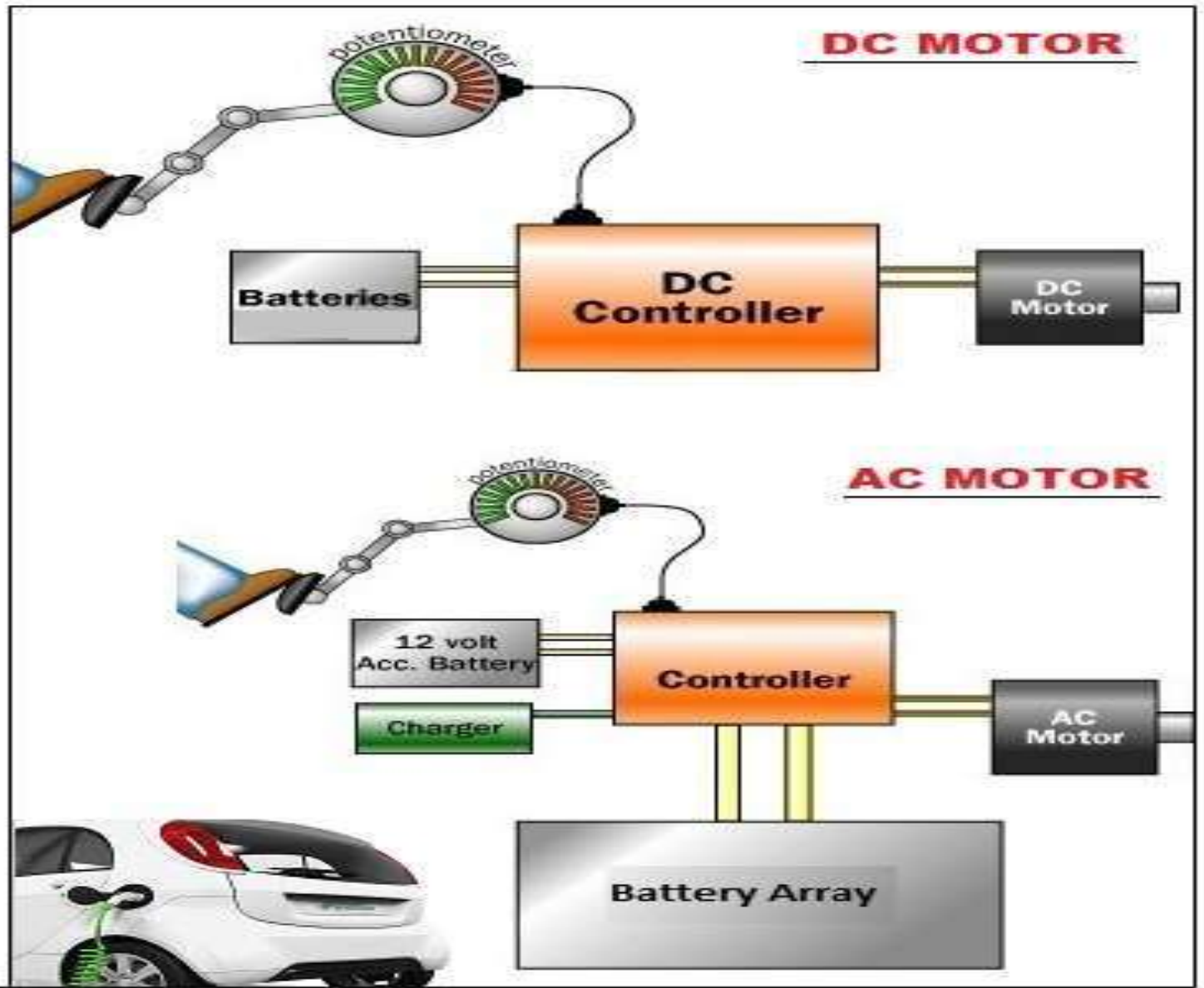
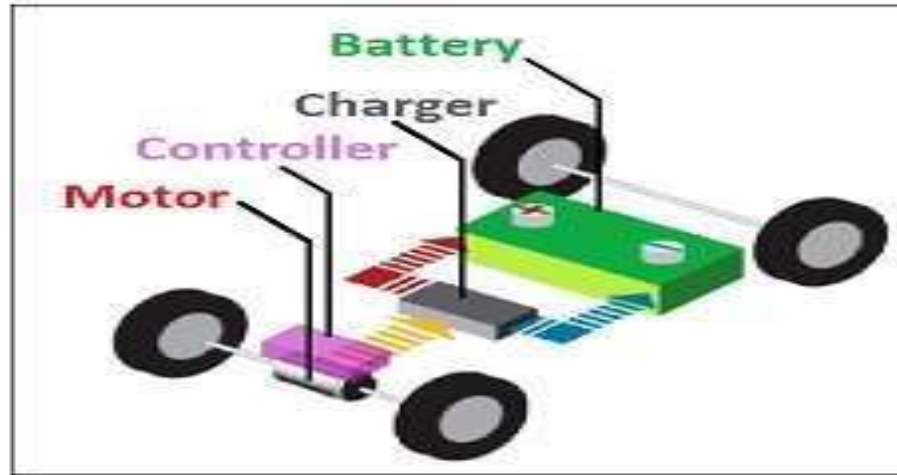
Source: <http://www.eaaev.org/History/index.html>



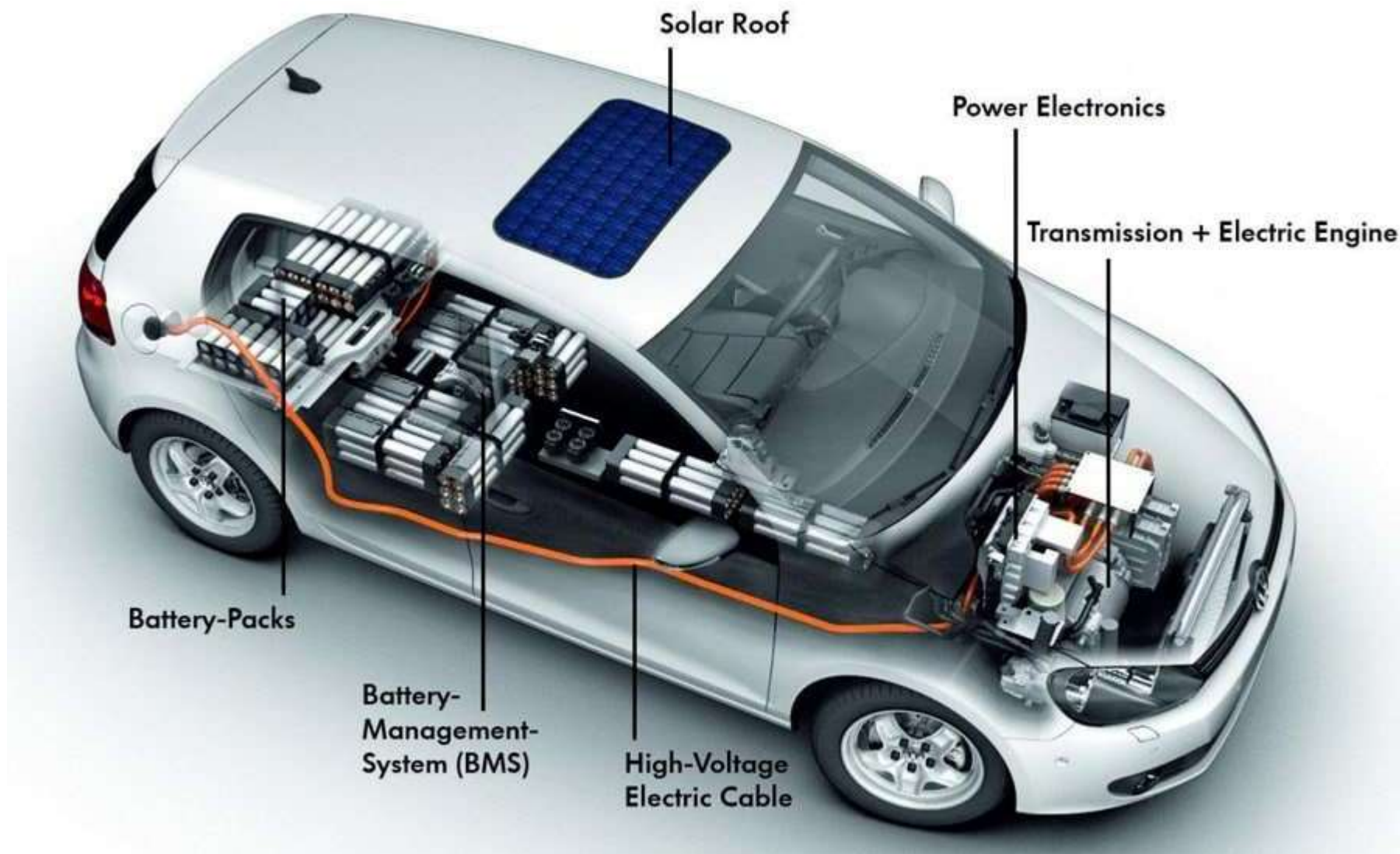


Hybrid electric vehicles

Vehicle Type	Electric Vehicle (EV)	Gasoline-Powered (Internal Combustion)	Plug-In Hybrid (PHEV)	Hybrid (HV)
Energy Source	Electric only	Gasoline only	Main: Electric Sub: Gasoline	Main: Gasoline Sub: Electric
Propulsion Mechanism	Motors	Engine	Combination of motor + engine	
CO2 Emissions	None	Yes	Yes	Yes
Fuel Facility Locations	Charging stations	Gas stations	Gas stations, chargers	Gas stations
Tax Liability	Low	High	Low	Low
Cruising Distance	Short	Long	Long	Long

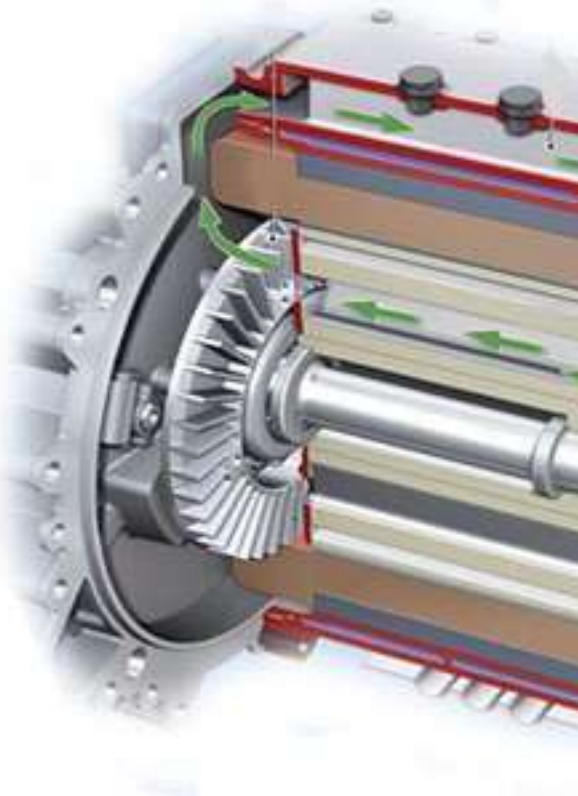


How EV's work

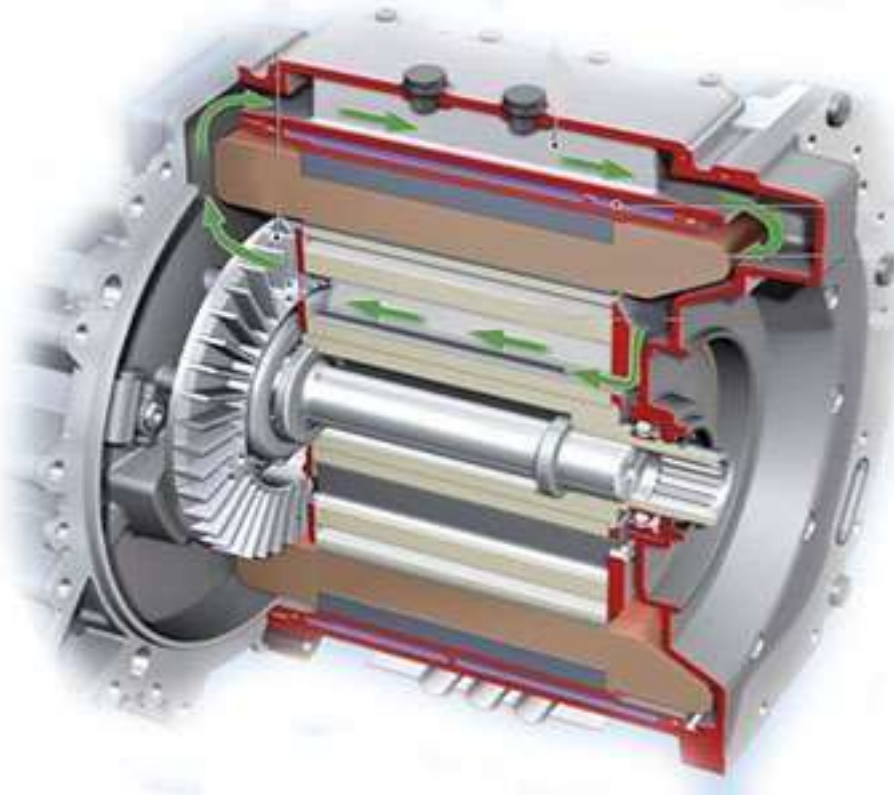


Solar roof

ELECTRIC TRACTION MOTOR



ELECTRIC TRACTION MOTOR



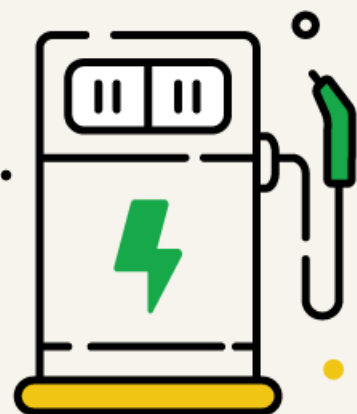
An **electric traction motor** is an electric motor optimized for **drive or propulsion**. Its primary purpose is to deliver **torque** to drive the wheels or axles of a vehicle, providing the necessary **traction** for movement.

IC Engine (ICE) Vehicles	Electric Vehicles (EV)
<ul style="list-style-type: none"> • Powertrain: IC engine • High specific energy of fuel • Power density: High • Emits greenhouse gases • Travels > 300 miles / fill • Short refilling time (< 5 min.) • Fuel tank takes less space • Fuel weight is very less • Higher maintenance costs • Braking energy not recovered • Running cost: high • Engine efficiency: ~ 30% • Needs complex gear system • Noisy operation • Ample refilling infrastructure • Need to pick up some speed to deliver maximum torque • Uses only hydrocarbons 	<ul style="list-style-type: none"> • Powertrain: Motor (+ Engine) • Low specific energy of battery • Power density: Low • No tailpipe emissions • Travels < 100 miles / charge • Long charging time (0.5-8 hr.) • Battery takes large space • Batteries are very heavy • Lesser maintenance costs • Can recover braking energy • Running cost: low • Motor efficiency: ~ 80% • Needs only one gear • Quiet operation • Lacks charging infrastructure • Produce maximum torque instantly after starting of motor • Uses electricity from many resources

Benefits of Driving an **Electric** Vehicle



Lower
**maintenance
costs**



Save on
fuel costs



Tax
breaks



Healthier
for the
environment

How EV works?

- https://www.youtube.com/watch?v=GHGXy_sjbgQ

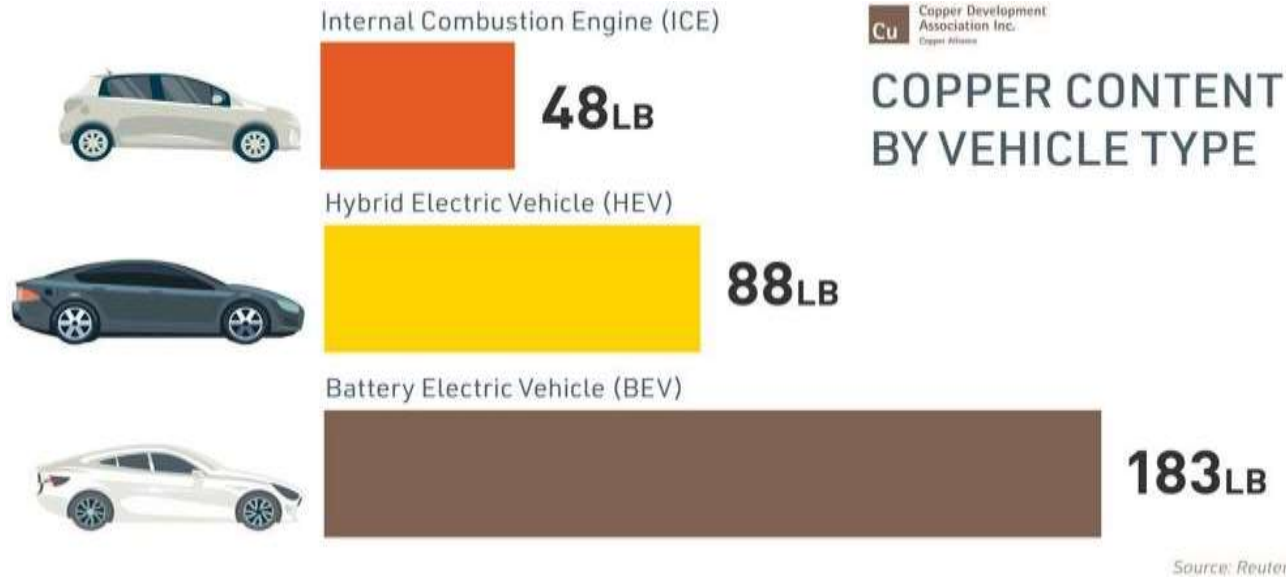
An Expensive Battery need to be replaced after 6-7 years

1




COST





On average a **battery electric vehicle (BEV)** contains about **83 kg of copper** and a plug-in hybrid electric vehicle (PHEV) contains about 60 kg compared with an average 23 kg in an internal combustion engine car," said Citi analyst Max Layton

Copper is **used** throughout **electric vehicles**, charging stations and supporting infrastructure because of the metal's durability, high conductivity and efficiency

The red metal is an essential component in **EVs**, and is **used in electric** motors, batteries, inverters and wiring

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Hydrogen Energy conversion: Fuel Cell

<https://www.youtube.com/watch?v=a4pXAmljdUA>

A fuel cell uses chemical energy of hydrogen to produce electricity

If hydrogen is the fuel then electricity, water, and heat are the only products

Fuel cells are more efficient and pollution free

For example, Fuel cell in Hydrogen cars

