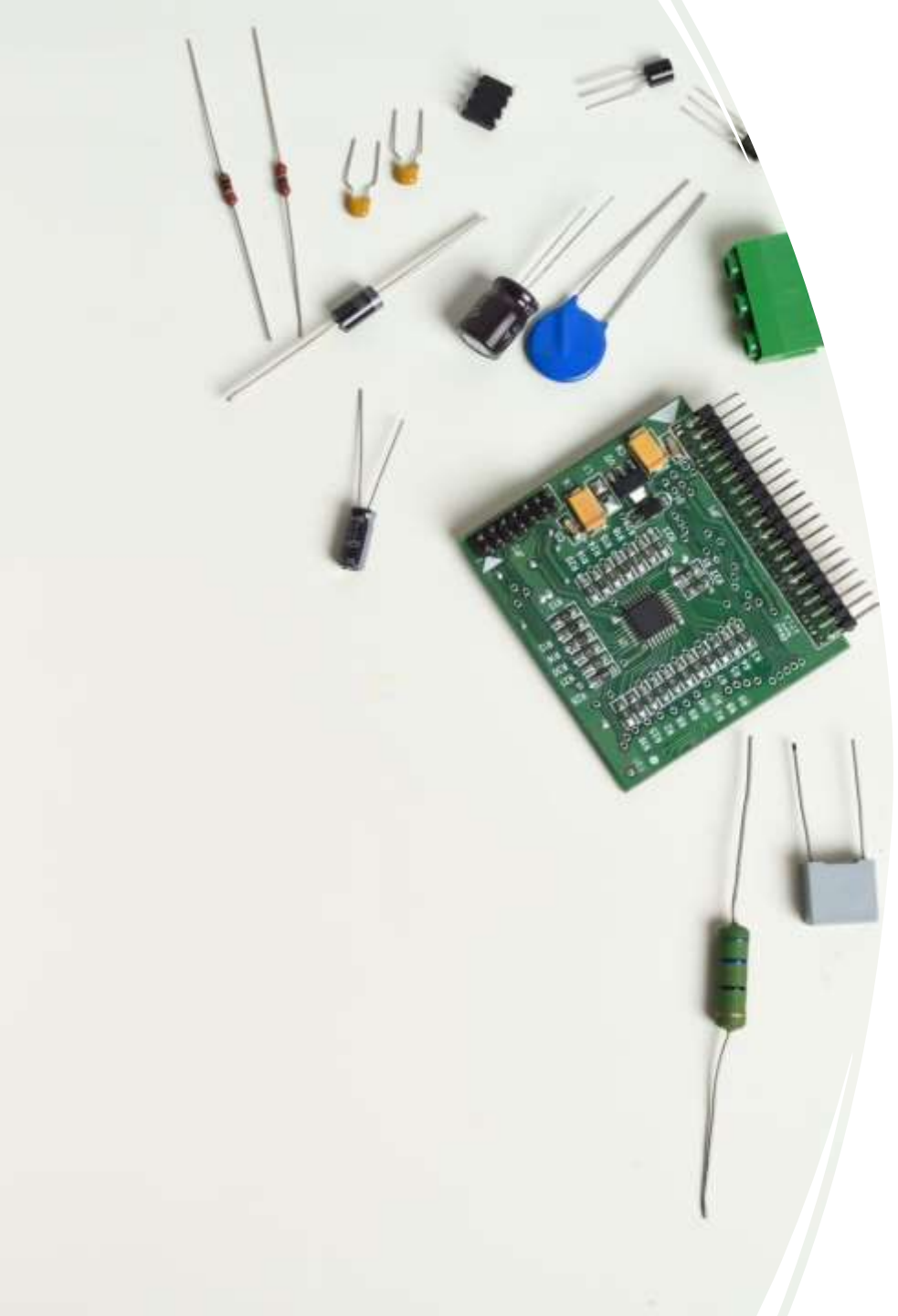
Tech for Non-Tech

Understanding & Explaining Electrically Propelled Vehicle Technology



Tech for Non-Tech

Course outline and duration.

1 day course to cover the following:

- Vehicle Types
- Vehicle drive formats
- Electricity explained
- Battery Technology
- The Legal Stuff
- What is Regenerative Braking/Self-Charging?
- Charging Methods & Ways to Charge
- Customer Relationship Management

Vehicle Types

- Electrically Propelled Vehicles?
- Propelled in part or in full Electrically

- List out in your workbooks as many different categories of Electrically Propelled vehicles you can think of.

Vehicle Types - Results

Plug-in Hybrids

Hybrids

Mild Hybrids

Range Extenders

Full Electric

Fuel Cell - Hydrogen

Quadricycles?

Vehicle Types

Mild Hybrids –

Define a Mild hybrid vehicle?

Common examples -

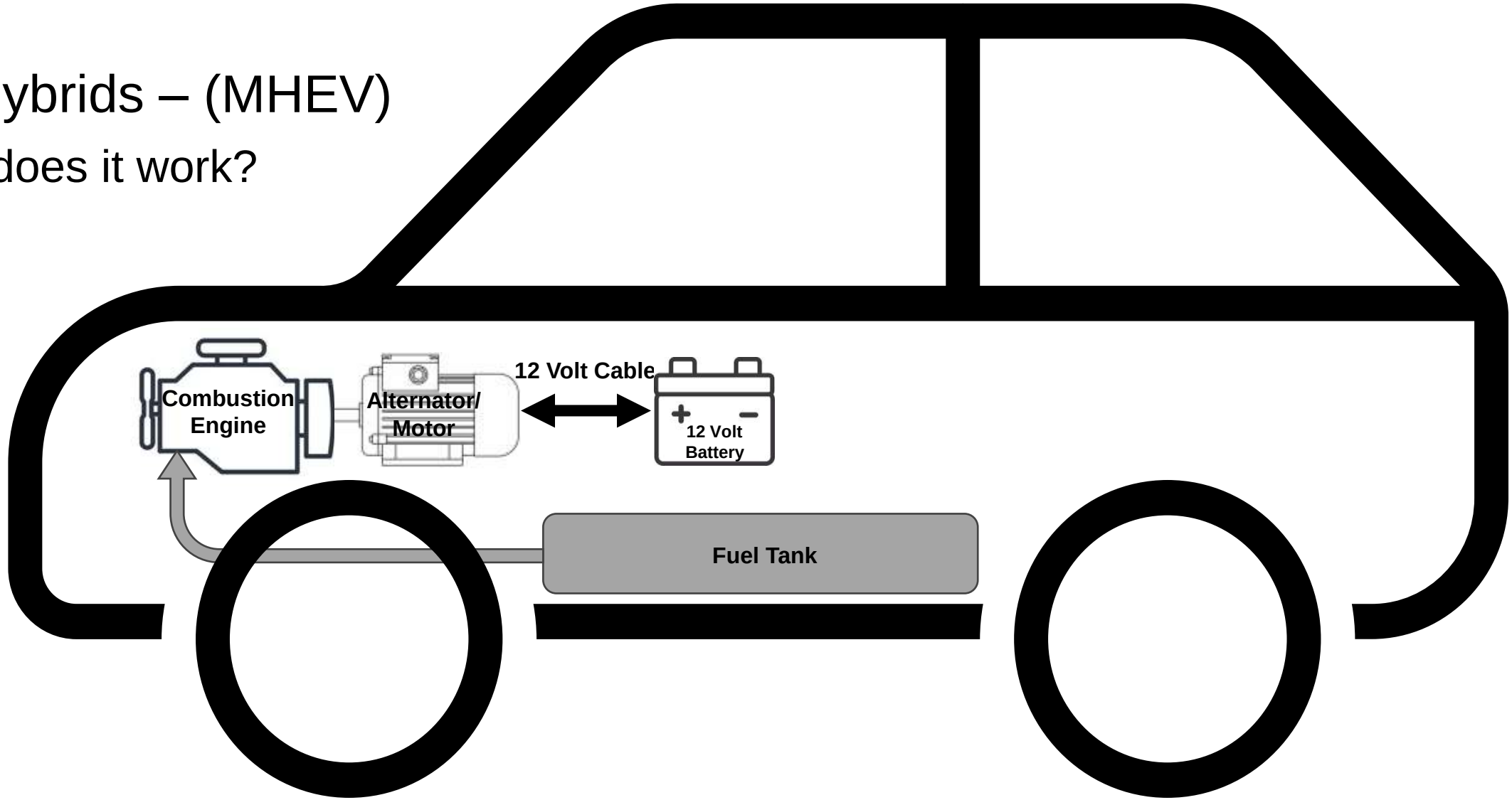
Vehicle Types

- Two types:
- 12-volt and 48-volt systems
- What’s the difference?

Mild Hybrid – 12 Volt system

Mild Hybrids – (MHEV)

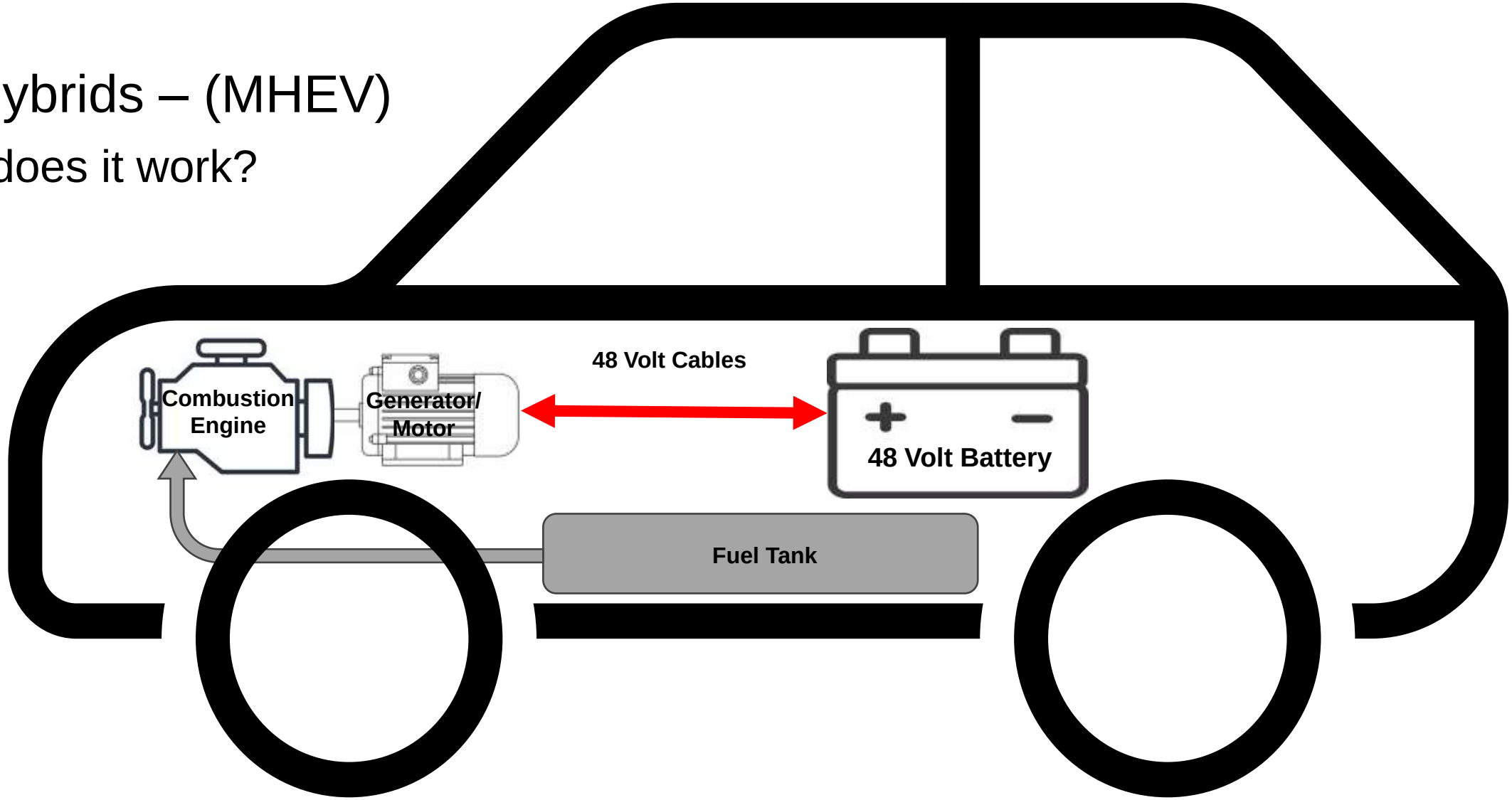
- How does it work?



Mild Hybrid – 48 Volt system

Mild Hybrids – (MHEV)

- How does it work?



Vehicle Types

Mild Hybrids –

- Do they need plugging in?
- Does it still emit exhaust fumes?
- HV battery – small/medium or large?
- How far can you drive electrically?
- What are the benefits?
- What are the downsides?

- Common Examples?

Vehicle Types

Hybrids –

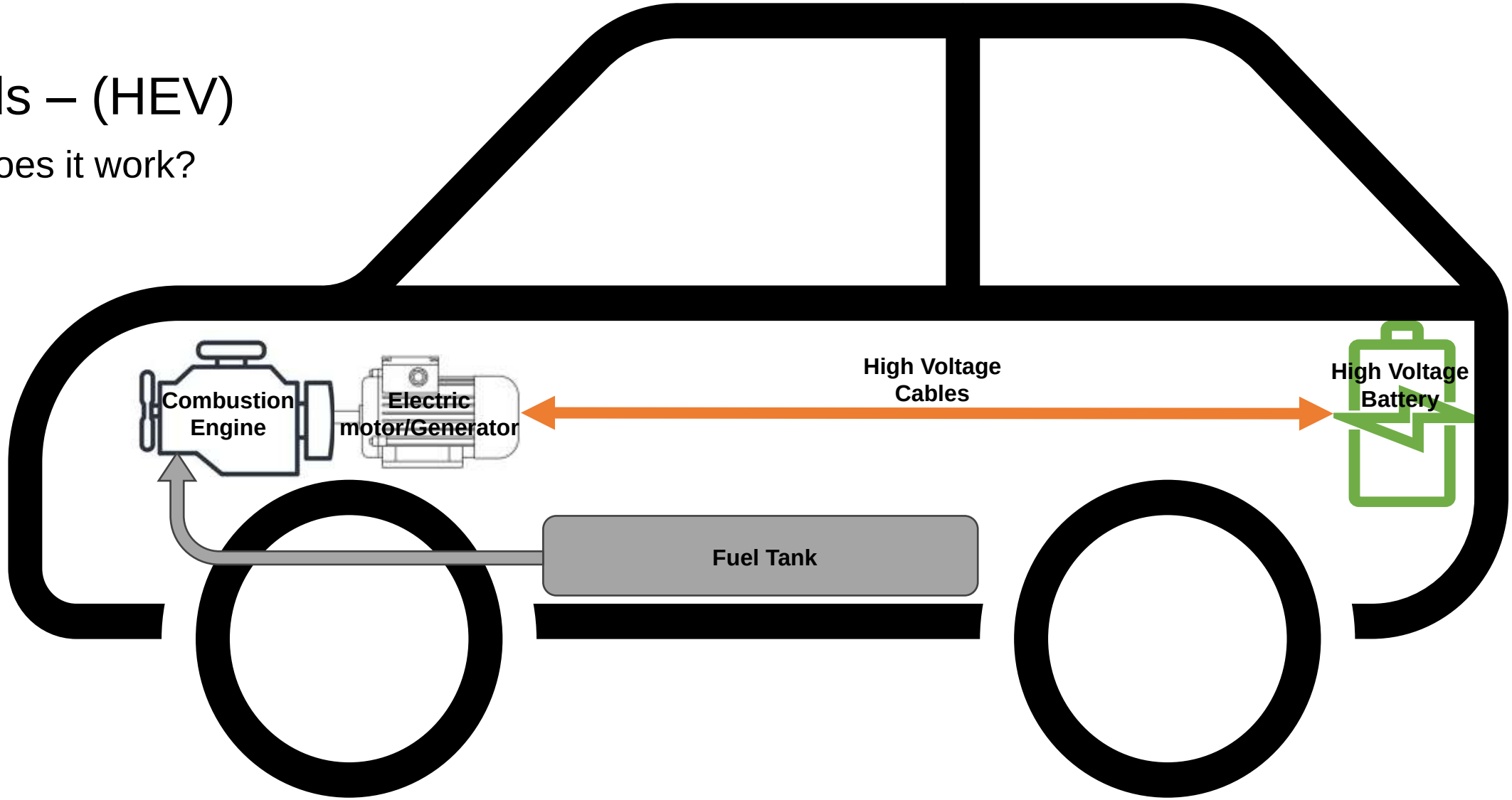
- Define a hybrid vehicle?

Common examples -

Vehicle Types

Hybrids – (HEV)

- How does it work?

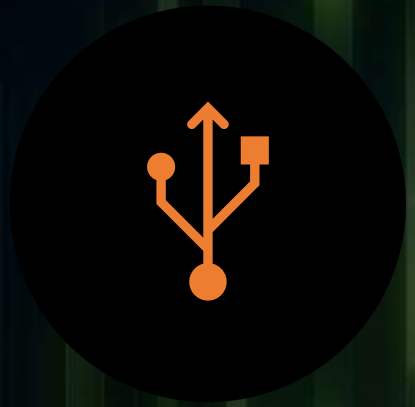


Vehicle Types

Hybrids –

- Questions?
  - Does it need plugging in?
  - Does it still emit exhaust fumes?
  - HV battery – small/medium or large?
  - What sort of range can you expect?
  - What's the main differences from a Mild Hybrid?
  - What are the benefits?
  - What are the downsides?

Vehicle Types



PLUG-IN HYBRIDS

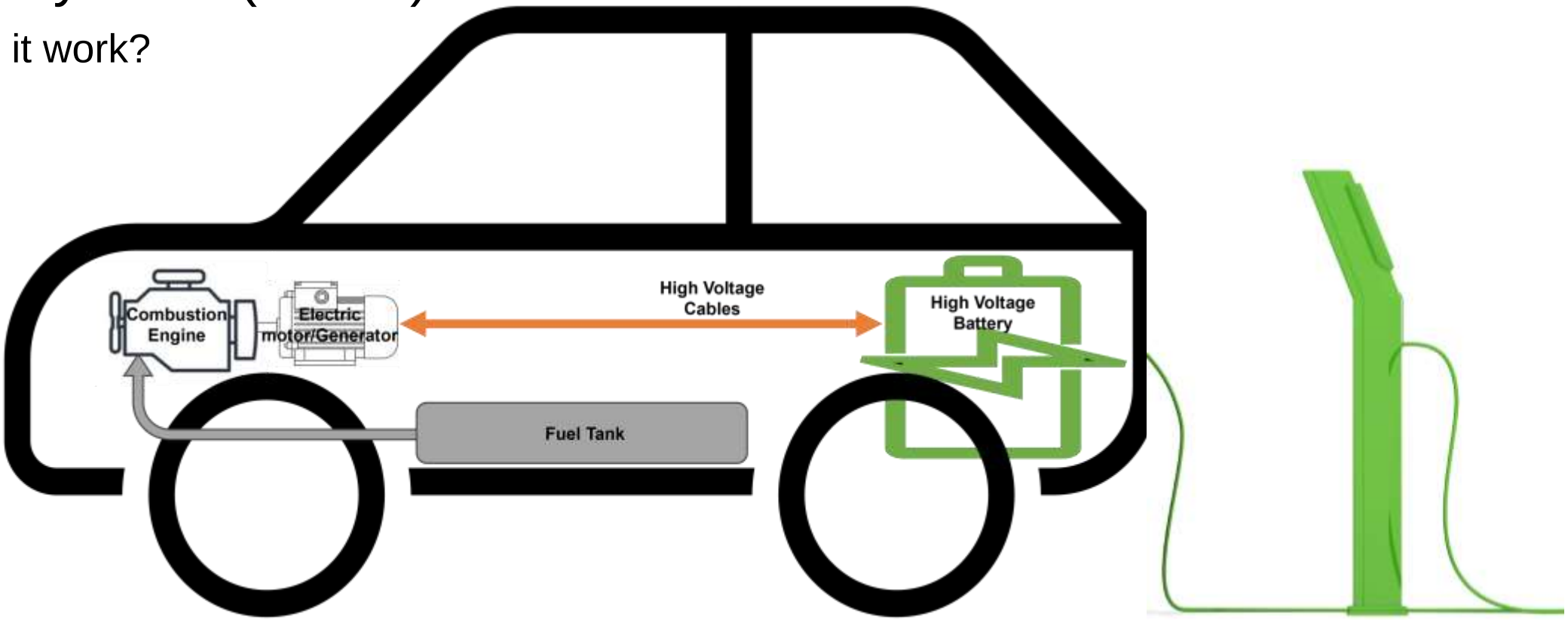
WHAT'S THE DIFFERENCE?

WHAT'S THE BENEFITS?

Vehicle Types

Plug-in Hybrids- (PHEV)

How does it work?



Vehicle Types

Plug-in Hybrids –

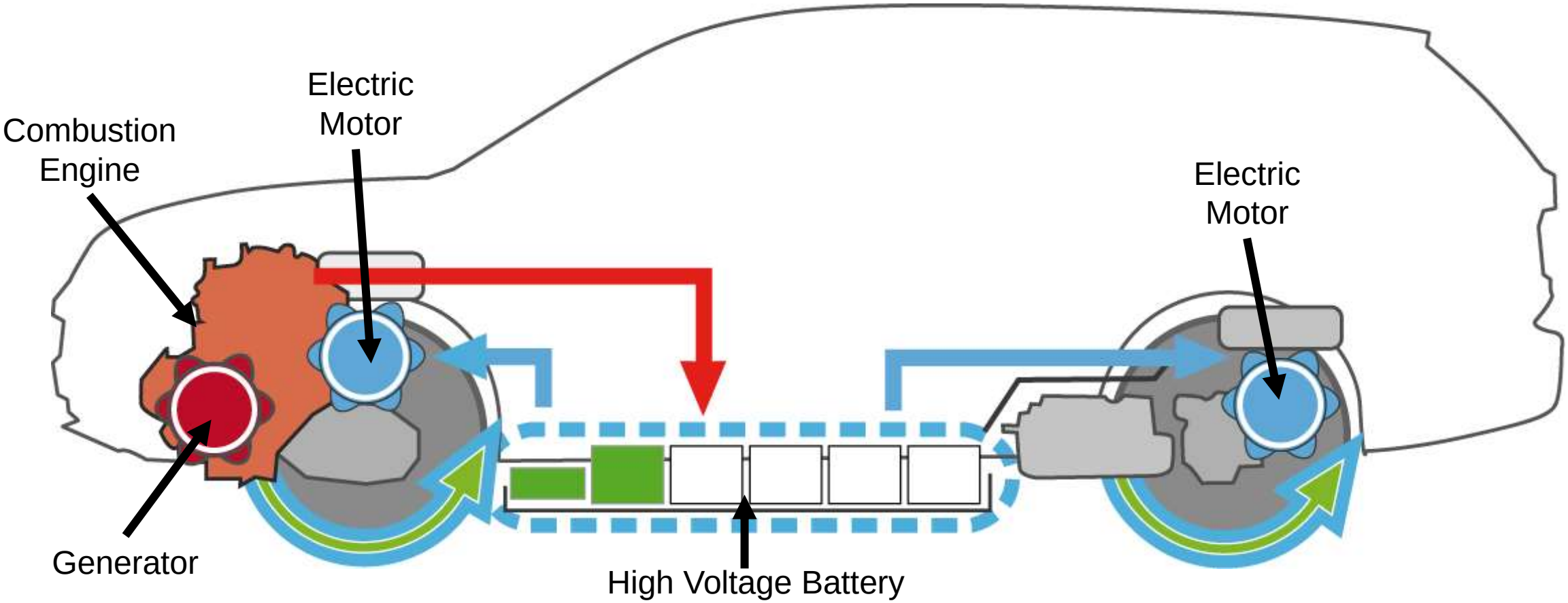
- Questions?
  - What's the benefit of plugging in?
  - Does it still emit exhaust fumes?
  - HV battery – small/medium or large?
  - What sort of range can you expect?
  - What's the main differences from a Hybrid?
  - What are the benefits?
  - What are the downsides?

Vehicle Types

Range Extenders! – (E-REV or RE-EV)

What are they?

Hybrid/Plug-Hybrid/Full Electric?



Vehicle Types – Range Extenders Examples…..

Vauxhall Ampera

Mitsubishi Outlander

Mazda MX-30

BMW i3

LEVC Taxi + Van Version

Vehicle Types

Range Extenders –

- Questions?
  - What are the main differences of a Range Extender?
  - Does it need plugging in?
  - Does it still emit exhaust fumes?
  - HV battery – small/medium or large?
  - What sort of range can you expect?
  - What are the benefits?
  - What are the downsides?

Vehicle Types

Full Electric – (BEV)

Zero Emissions

No Fuel

Battery size

Range

Always plug-in

Vehicle Types

Full Electric –

Questions?

Is range anxiety still a concern?

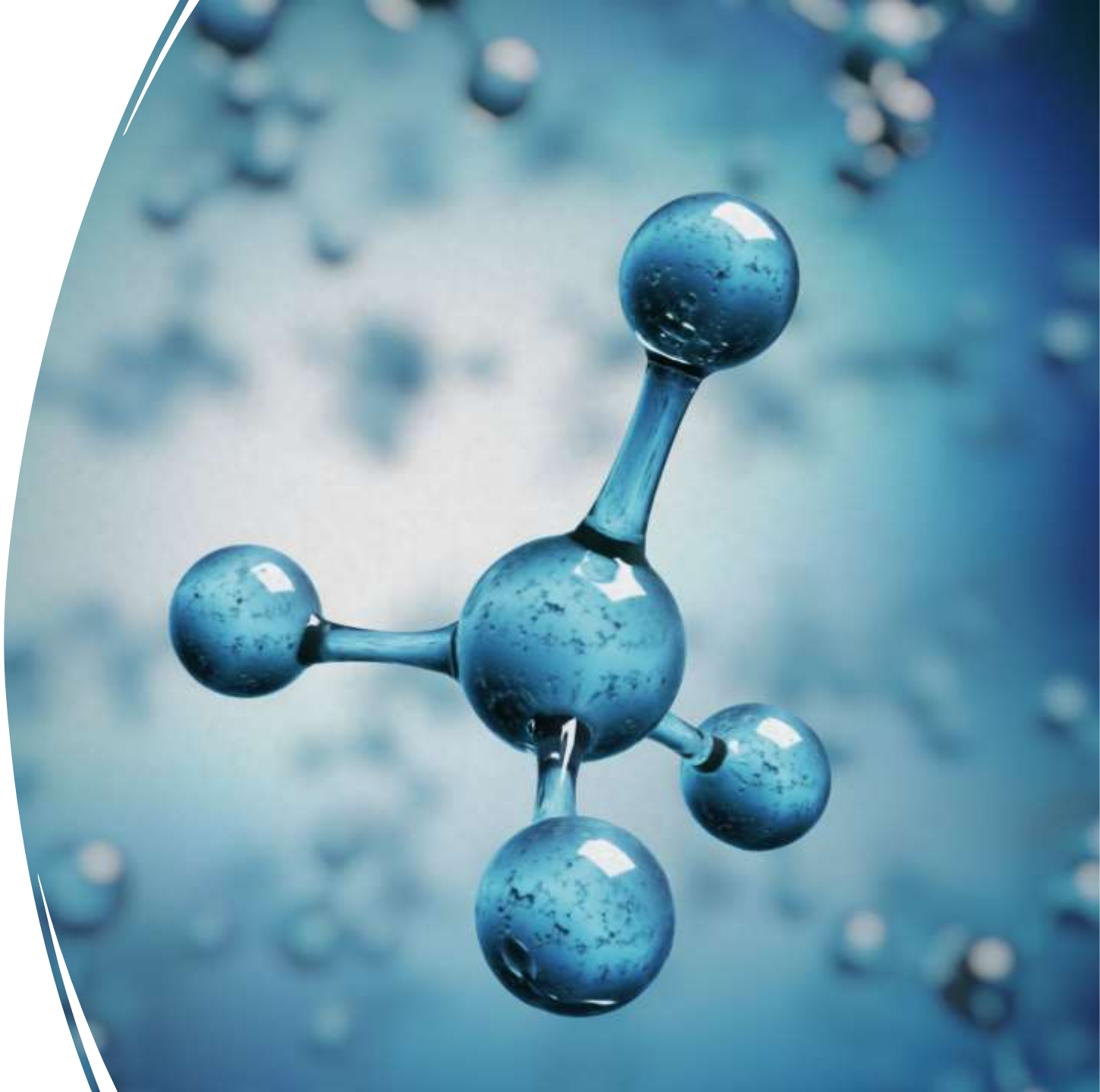
What is the national daily average mileage?

What is the average range of most new BEV’s on offer?

Vehicle Types

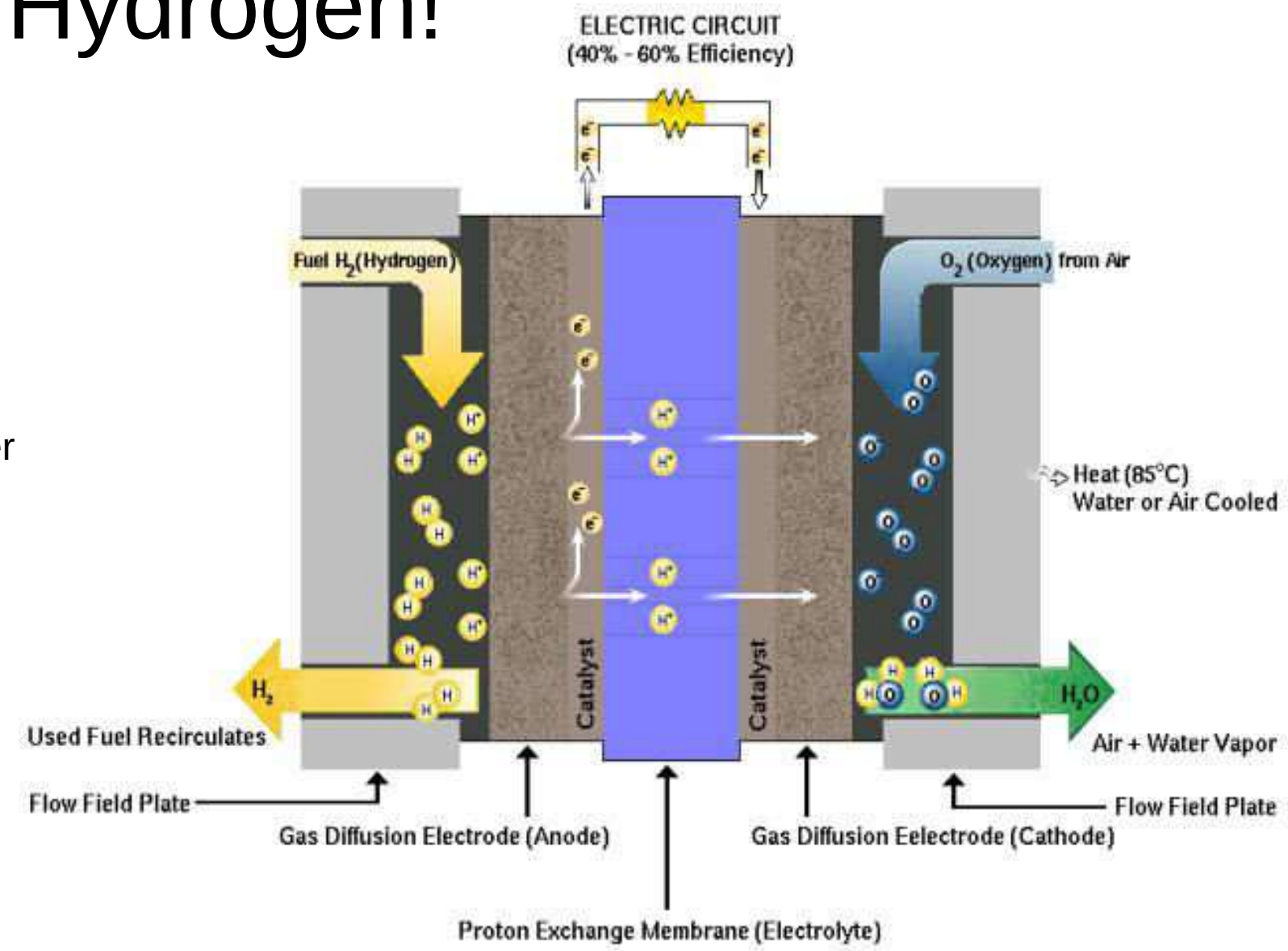
Fuel-Cell – Hydrogen!

How does it work?



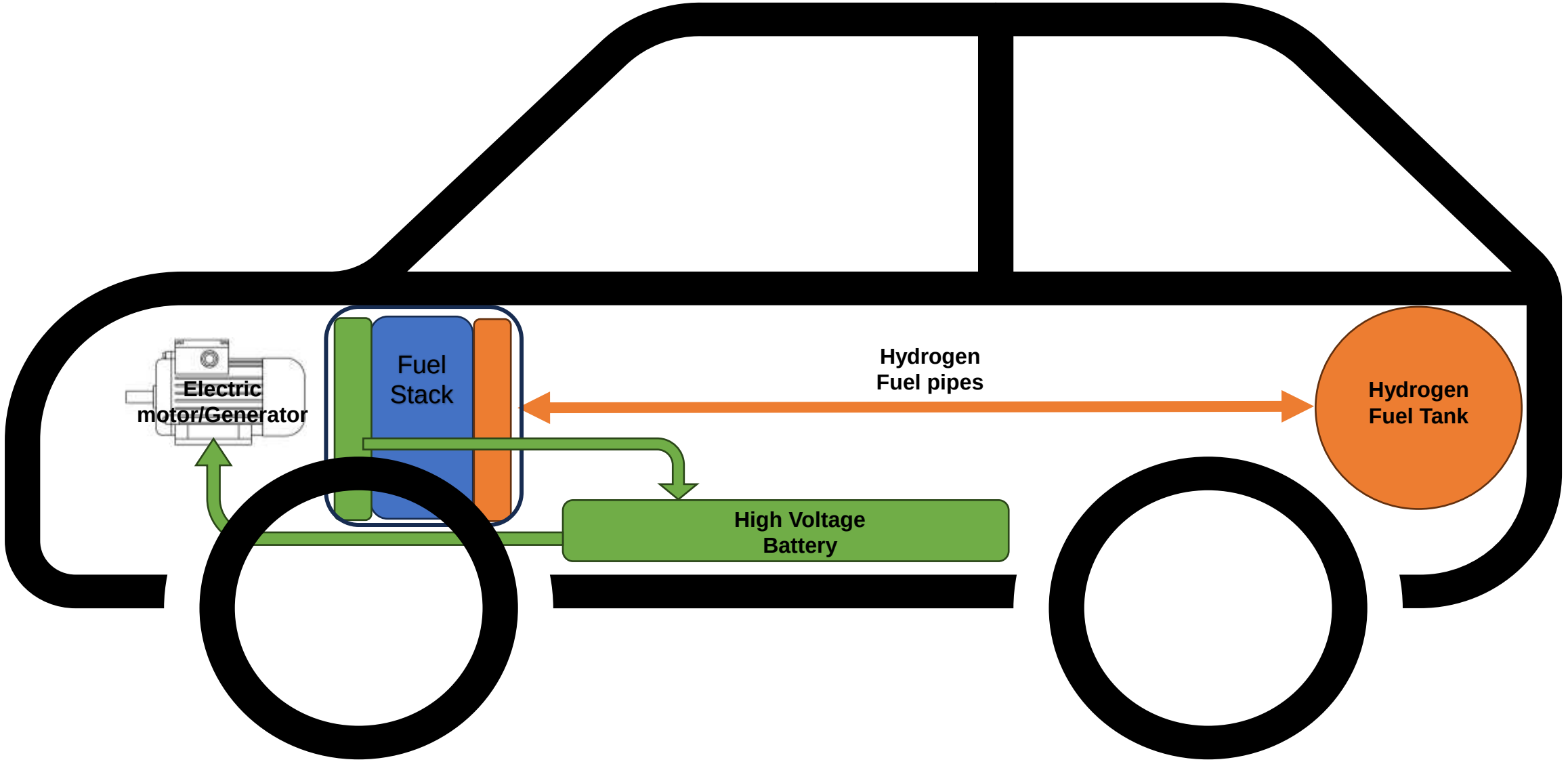
Fuel-Cell – Hydrogen!

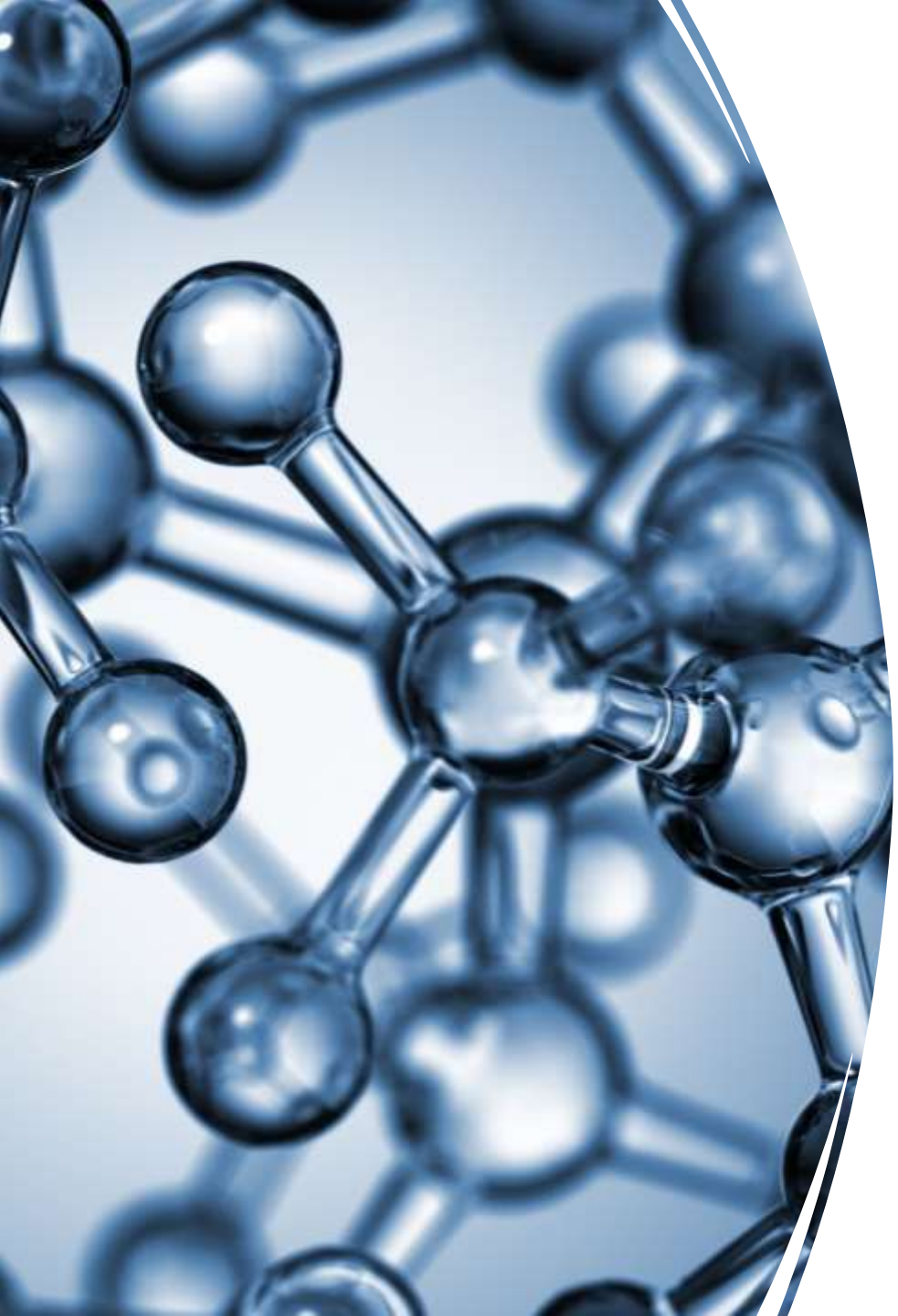
- Fuel – Hydrogen
- Produces Electricity
- Emissions – H2O – Water



HOW DOES A FUEL CELL WORK?

Fuel-Cell – Hydrogen!





Fuel-Cell – Hydrogen!

Additional notes for Hydrogen Fuel Cell vehicles:

- Tanks size – 6 – 8 Kilos
- Price per Kilo - £10 - £15
- Range – Similar to conventional
- Pressures – 350 bar (5000psi) or 700 (10000psi)
- Poor accessibility – filling station network.
- Needs to be 100% pure – damage to PEM will occur
- Limited choice to purchase
- Very limited technical support – Garages for maintenance/servicing/repair

Fuel-Cell – Hydrogen!

- Current availability in the UK:

Toyota Mirai and Hyundai Nexo

Starting price: £53,300

Starting price: £68,800

Quadricylces?

Definition:

- The quadricycle is a European Union vehicle category for four-wheeled microcars, which allows these vehicles to be designed to less stringent requirements when compared to regular cars. Quadricycles are defined by limitations in terms of weight, engine power and speed.
- Heavy quadricycles do not carry a top speed restriction but are still restricted to a maximum power of just 15kW and an unladen mass of 400kg – extended to 550kg for quadricycles intended to carry cargo, and also having the same exception as electric light quadricycles whereby battery weight is not counted towards this limit.
- As they are not considered to be passenger cars, the licensing requirements for quadricycles in Europe are more akin to mopeds rather than passenger cars. In general, this means that in most EU countries, anyone above the age of 16 can drive a quadricycle (without being accompanied by another driver).
- These are becoming more popular in remote and heavy congested area in the UK due to low cost and little licensing regulation.

Quadricylces?

- What are they?

Fiat Topolino

Bajaj Qute

Ark Zero

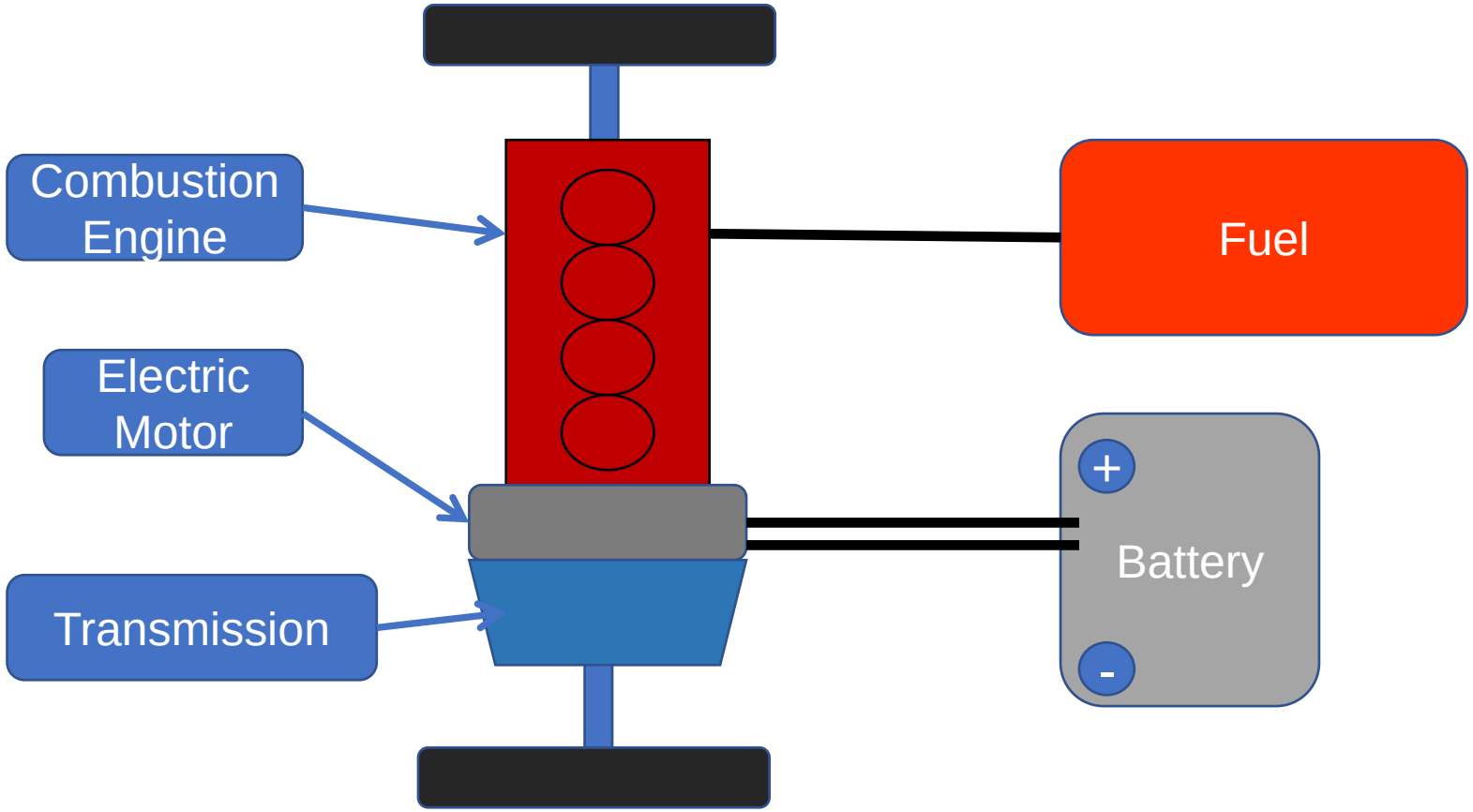
Citroen Ami

Renault Twizzy

Vehicle drive formats – Hybrids

1. Parallel
2. Series
3. Power Split
4. Dual

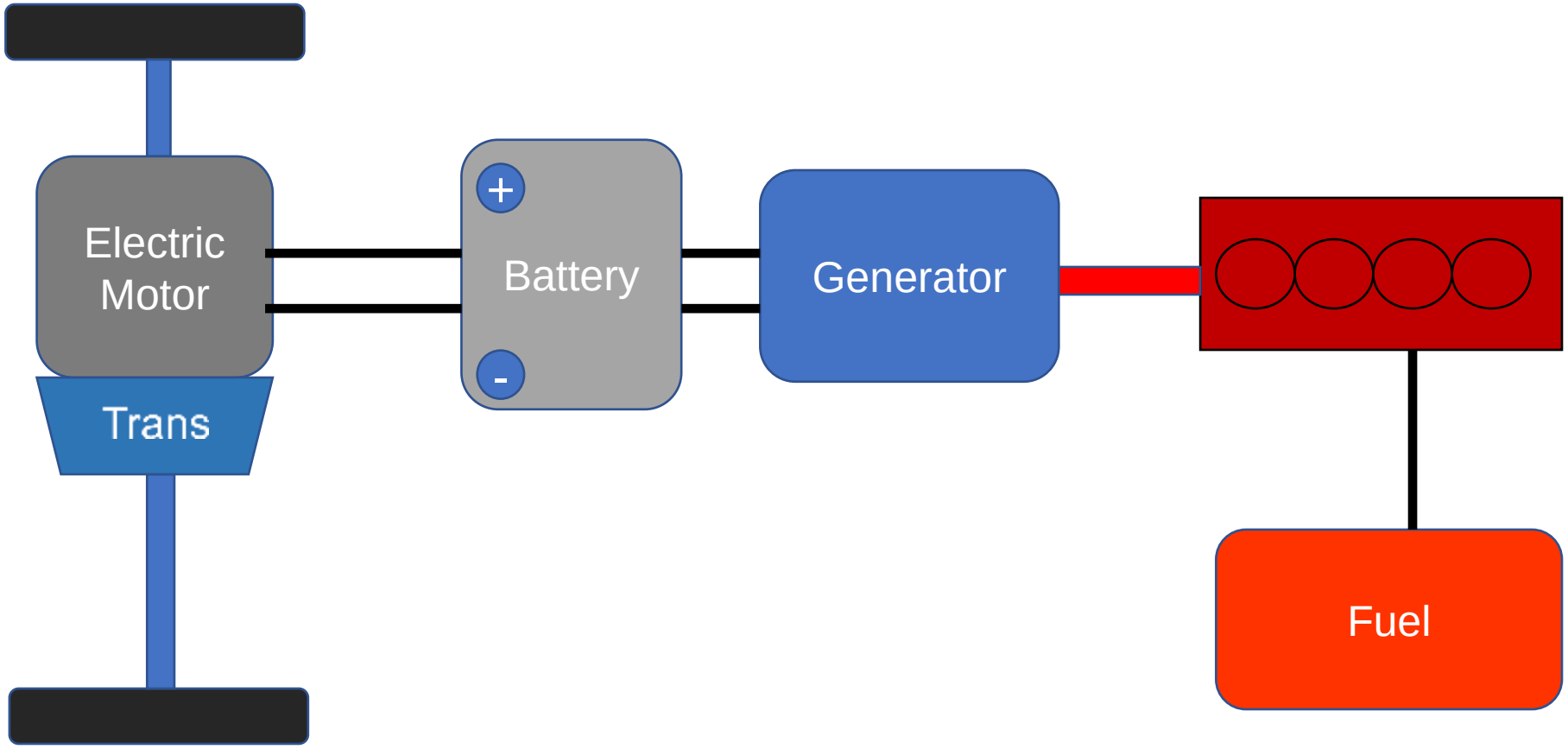
Hybrid Layouts – ‘Parallel’



Hybrid Layouts

Give some examples of Manufacturers Makes and models that would utilise a Parallel system:

Hybrid Layouts - ‘Series’

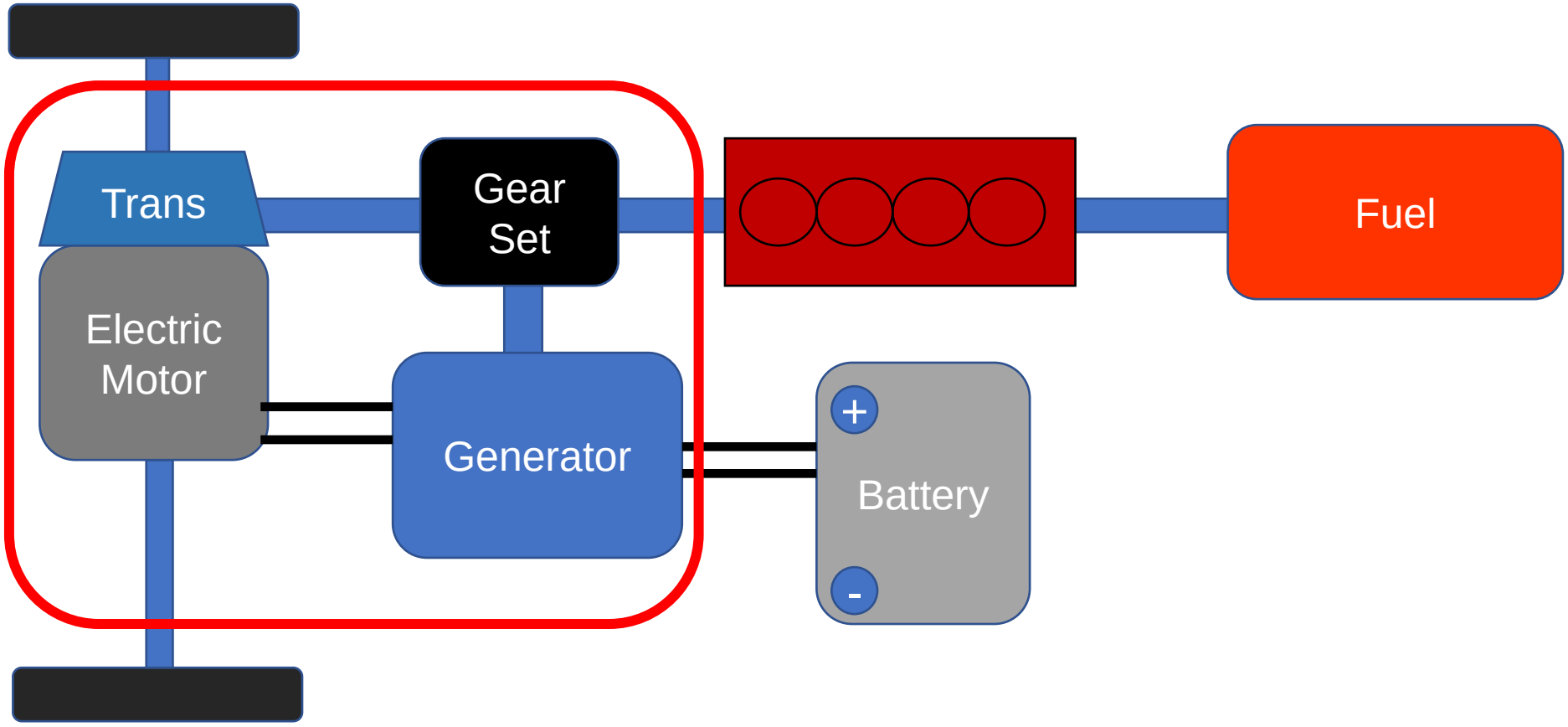


Hybrid Layouts

‘Series’

What's the benefits of a Series type layout for a vehicle?:

Hybrid Layouts - ‘Power Split’

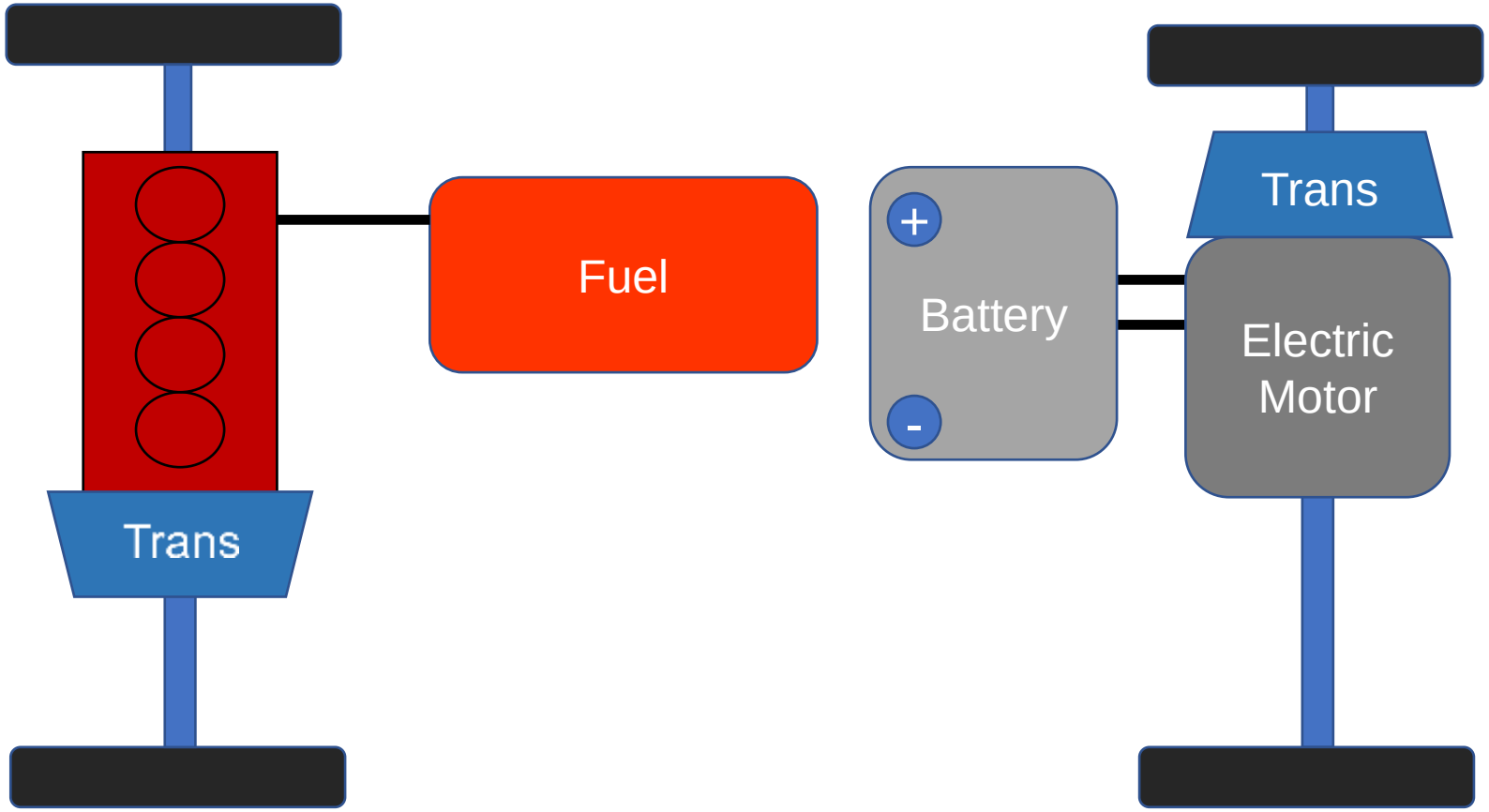


Hybrid Layouts

‘Power Split’

Which manufacturer introduced the Power Split System?:

Hybrid Layouts - ‘Dual’



Hybrid Layouts

‘Dual’

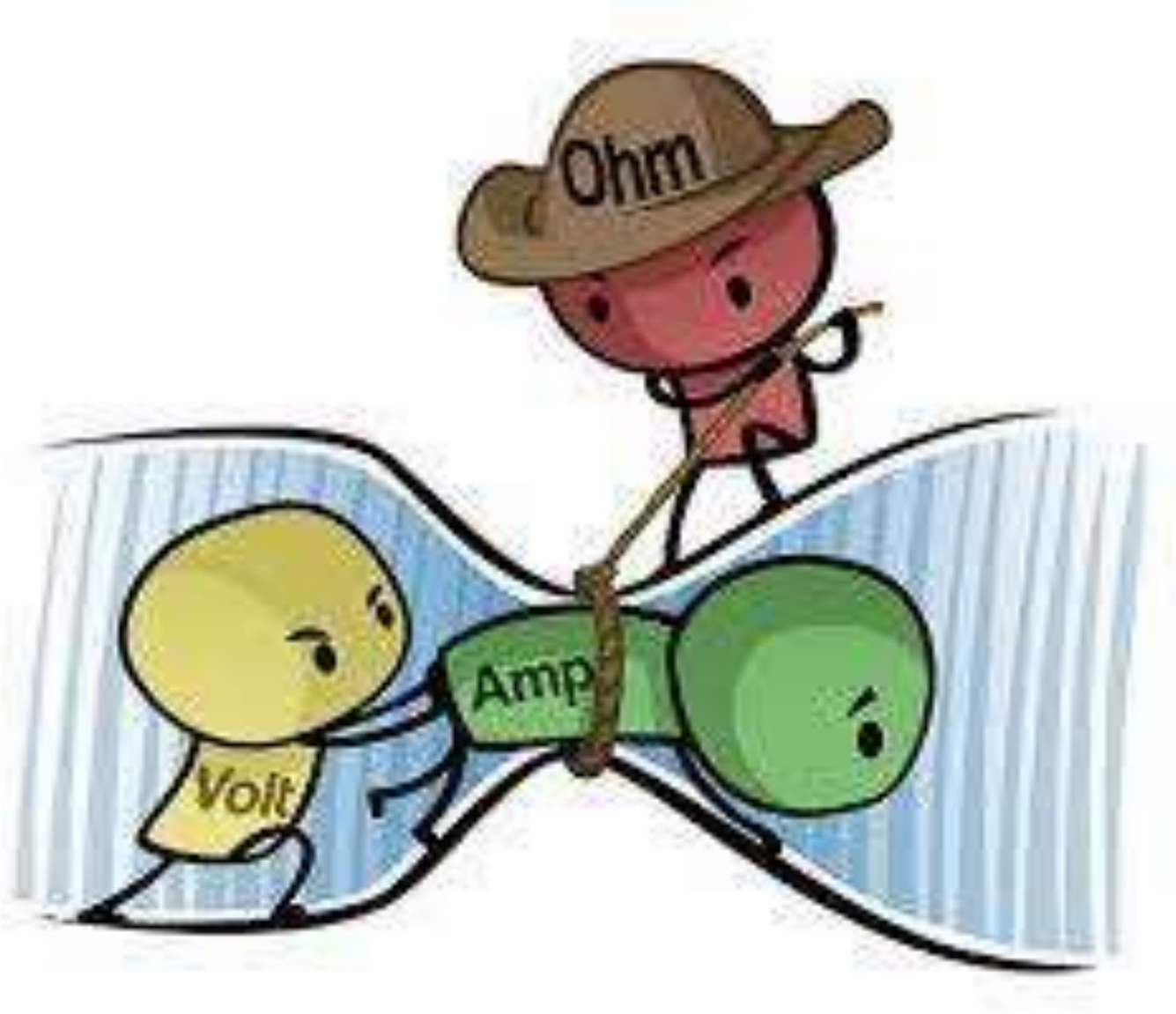
Give some examples of Manufacturers Makes and models that would utilise a Dual system:

Electricity Explained

Electricity can be compared to the flow of water:

- Volts = Pressure
- Amps = Volume
- Ohms = Resistance

1. The higher the voltage, the higher the pressure or potential.
2. The higher the Amps, the greater the volume or flow.
3. The higher the Ohms, the greater the resistance or restriction to flow.



Electricity Explained

Two types of electricity:

Alternating (Current) – AC

Direct (Current) - DC

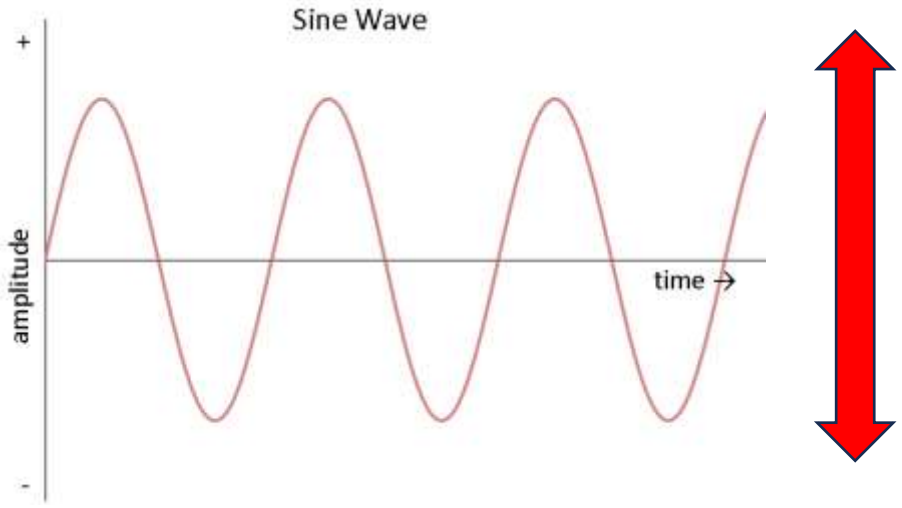
Electricity Explained

Difference between DC (Direct Current) & AC (Alternating Current).

Alternating Current (AC):

- Pressure alternates
- Changes direction
- The speed of alternation is referred to as frequency. Hertz -Hz
- Example -National Grid supply (UK) is 50 Hz Frequency.
- The higher the voltage, the higher the pressure or potential.
- Electric motors for Electric Vehicles use Alternating current.
- AC cannot be stored.
- Needs inverting from DC to AC for Motors

Alternating Current



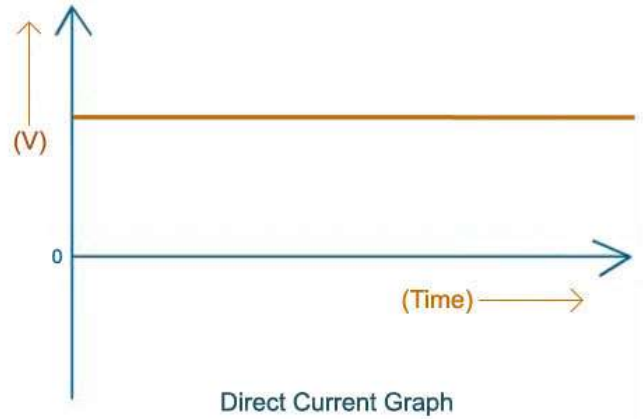
Electricity Explained

Difference between DC (Direct Current) & AC (Alternating Current).

Direct Current (DC):

- Constant pressure
- In one direction
- The higher the voltage, the higher the pressure or potential.
- 50 volts or above is considered dangerous.
- All Electric vehicles are above 50*. (Usually between 200 – 400 volts)
- Batteries store DC voltage.

Direct Current



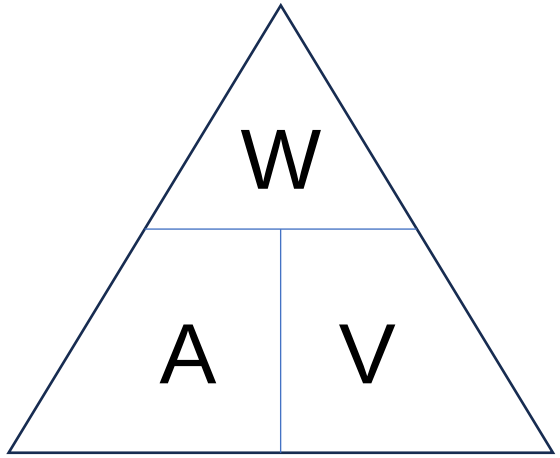
Direct Current Graph

Including some Mild hybrid vehicle that use 48-volt batteries

Electricity Explained

Electrical power explained: Watts Law……

Referred to as Watts.
Watts law calculates electrical power.
Example: Light bulb – the higher the wattage the brighter the bulb and the more power it consumes.



A x V = W

Amps x Voltage = Watts

Electricity Explained

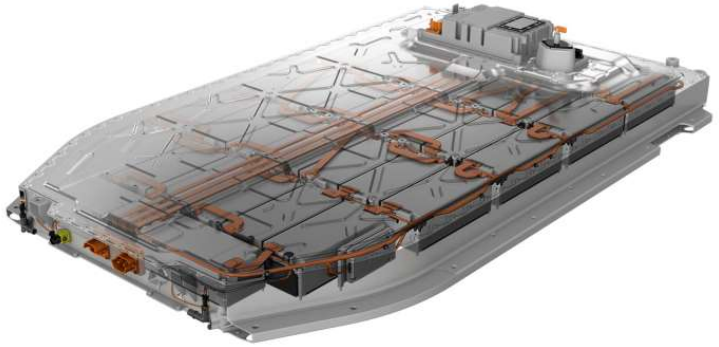
Use Watts Law to understand the power output of Batteries:

1. Vehicle 12-volt battery.

- The voltage is 12 volts.
- The available amps 100 - 300 amps.
- The resistance, very low.

2. Electric vehicle drive High voltage battery.

- The voltage is 400 volts. (Average but varies)
- The available amps 100 - 450 amps.
- The resistance, very low.



1. 12 volts x 200 amps = 2,400 watts or 2.4 Kilowatts (Kw)

2. 400 volts x 300 amps = 120,000 watts or 120 kilowatts (Kw)

Electricity Explained

Use Watts Law to understand the power output of Electric Motors:

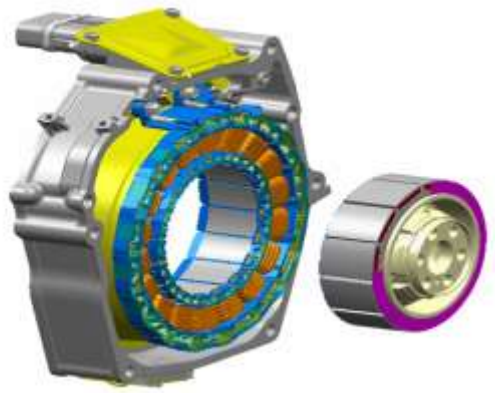
Example: 500 volts x 100 amps = 50,000 watts or 50 Kilowatts (Kw)

Kw Electric Motor output for vehicles range from 10 Kw to 300 Kw.

Average sized vehicle would be approximately 35 – 45 Kw.

Vehicle Electric Motor example:

- The voltage is 500 volts.
- Amps used = 100 amps.
- Internal resistance will affect output.



Electricity Explained

Electrical capacity explained:

The number of watts delivered over time.
Comparison: The flow of fuel (gallons) over time – MPG
Watts over time = Kilowatts per hour or ‘Kwh’.

The higher the Kwh, the larger the capacity of the battery.
The vehicle can be driven further or has a greater range.

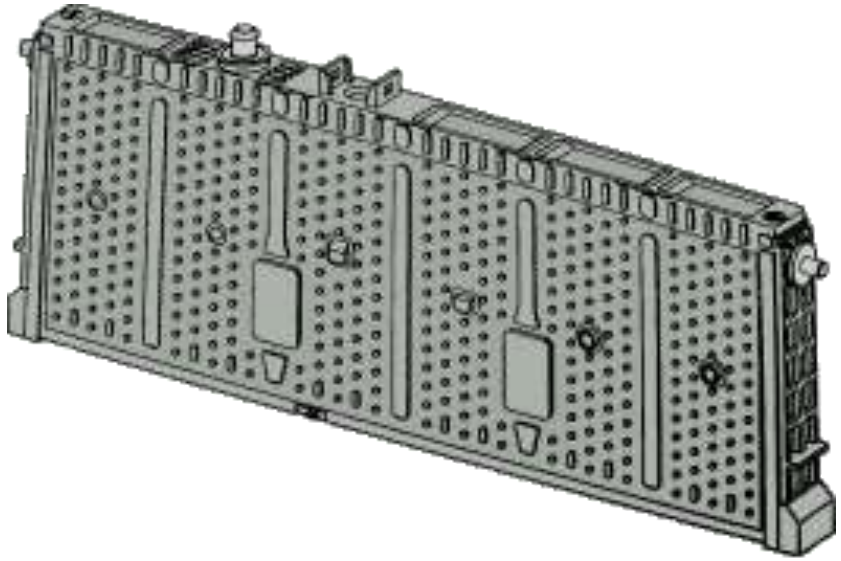
Examples:

Renault Zoe: 40 Kwh (Ave) = 155 - mile range
Tesla Model S: 100 Kwh (Ave) = 400 - mile range


Battery Technology

Battery Types

- 3 types of battery can be found on Electric Vehicles
  - Lead Acid (PbAc) – fitted for the conventional 12 volt system to supply general electrical systems.
  - Nickel Metal Hydride (NiMH) – Early adoption for High Voltage Vehicle systems.
  - Lithium Ion – (Li-ion) Current preferred battery for larger capacity. (12 Volt Batteries)

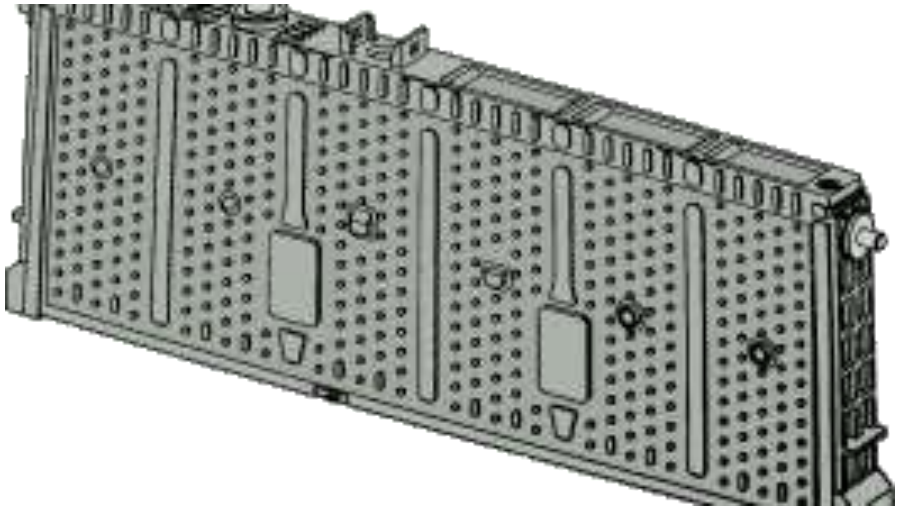


Lead Acid Batteries

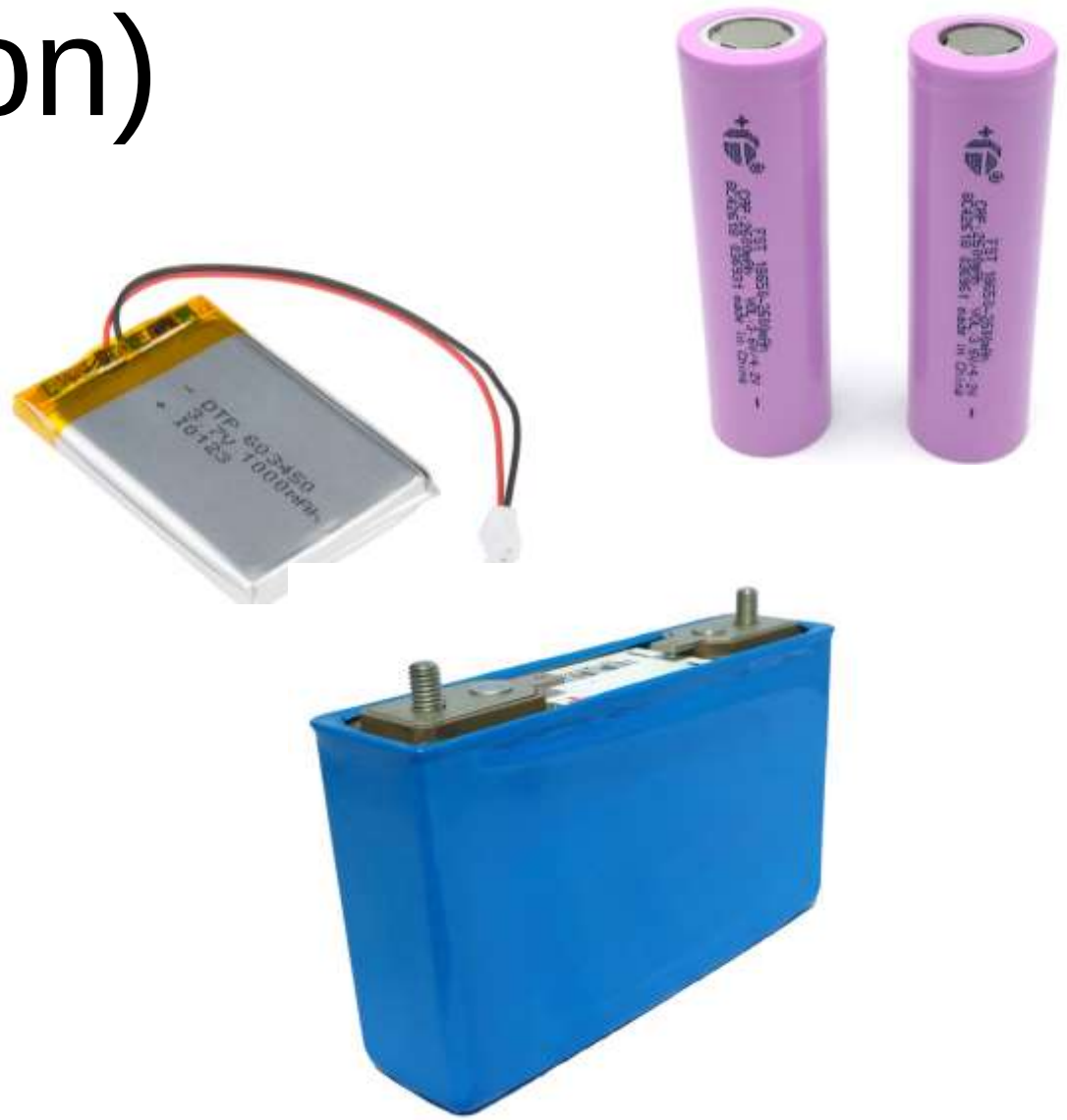
- Found on all vehicle types to power the electrical 12-volt system.
  - Separate to the High Voltage system.
  - Central Locking, Lighting, Audio, Engine starter motor, Wipers etc.
  - Robust and reliable, can operate in all temperatures and climates.
  - Limited in capacity and heavy.
  - Will deplete over a relatively short time and needs replacement.
  - Low cost.
  - Requires little maintenance and no management for performance.

Nickel Metal Hydride (NiMH)

- First battery type used for Hybrid Electric Vehicles.
  - Used for the High Voltage system.
  - Offers better energy density compared to Lead Acid Batteries.
  - Very reliable.
  - Good service life.
  - Very little maintenance.
  - Needs voltage, current and environment management to maintain performance and service life.



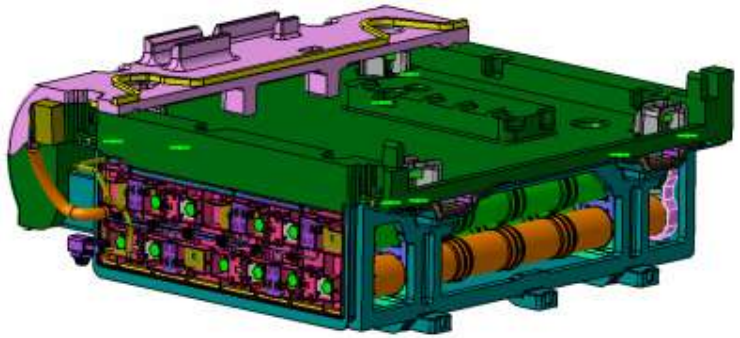
Lithium Ion – (Li-ion)



- Most commonly used battery for current (Full) Electric Vehicles.
  - Used for High voltage system.
  - Very high energy density.
  - Expensive.
  - Difficult to manufacture.
  - Can be volatile if not managed and monitored correctly.
  - Medium service life but improved when managed.
  - Needs voltage, current and environment management to maintain performance and service life.

Battery Assembly

- High Voltage battery packs come in many different forms, which depend on several factors
    - Shape & size – available space
    - Capacity – range & performance
    - Location/position on vehicle



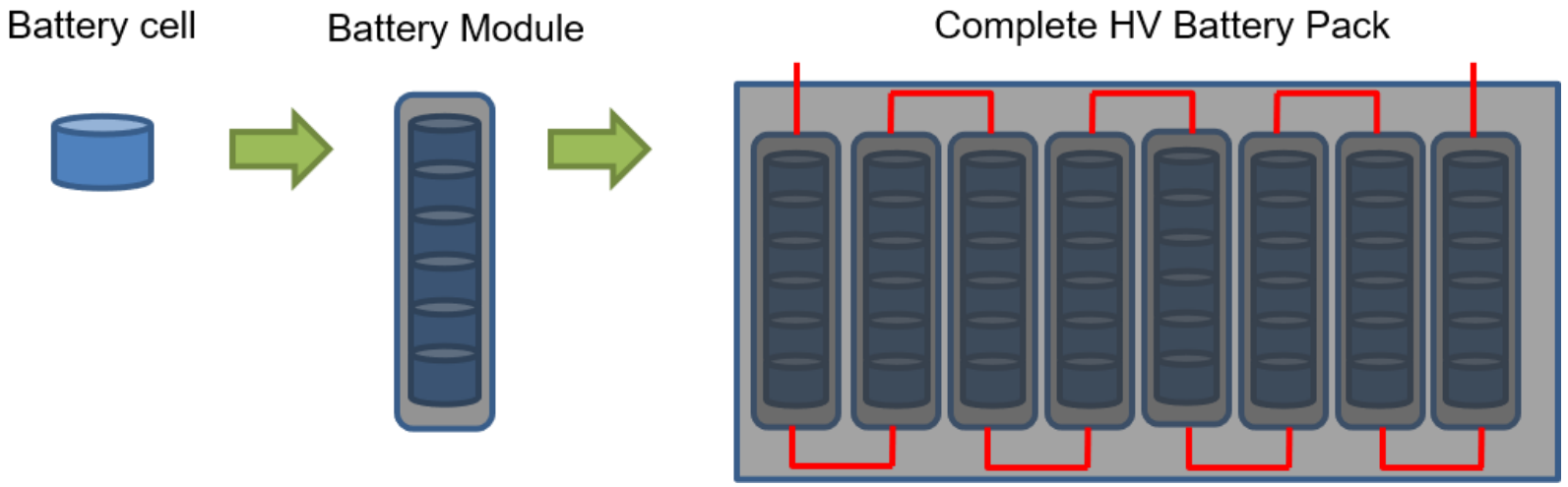
Battery Assembly

- Battery packs are made of many individual cells.
  - To increase the voltage.
  - To increase capacity.
  - Improve reliability.

- Voltage ranges:
  - Hybrid 100 – 200 volts approximately
  - Plug-In Hybrids 200 – 300 volts approximately
  - Range Extenders and Pure Electric 300 - 400 volt approximately
  - Development and introduction of 800-volt batteries

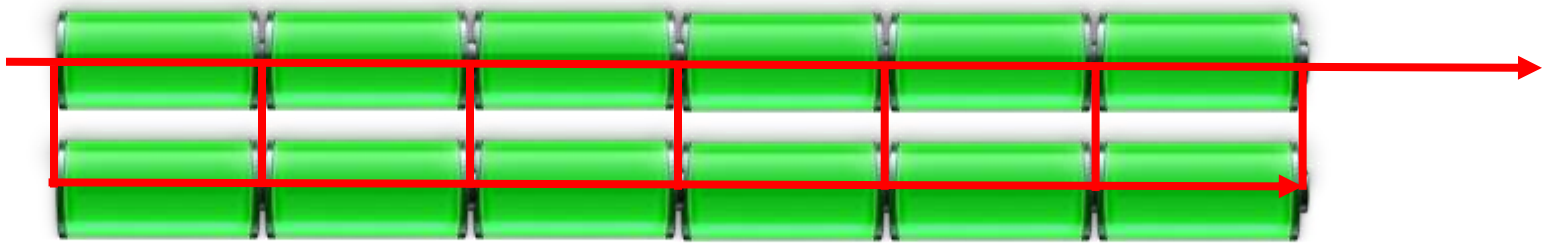
Battery Assembly

- Individual battery cell voltage will range from 1.2 volts to 3.7 volts.
- To increase the voltage, batteries need to be assembled in series, usually into modules.
- Modules are then assembled in series to make a High Voltage Pack.

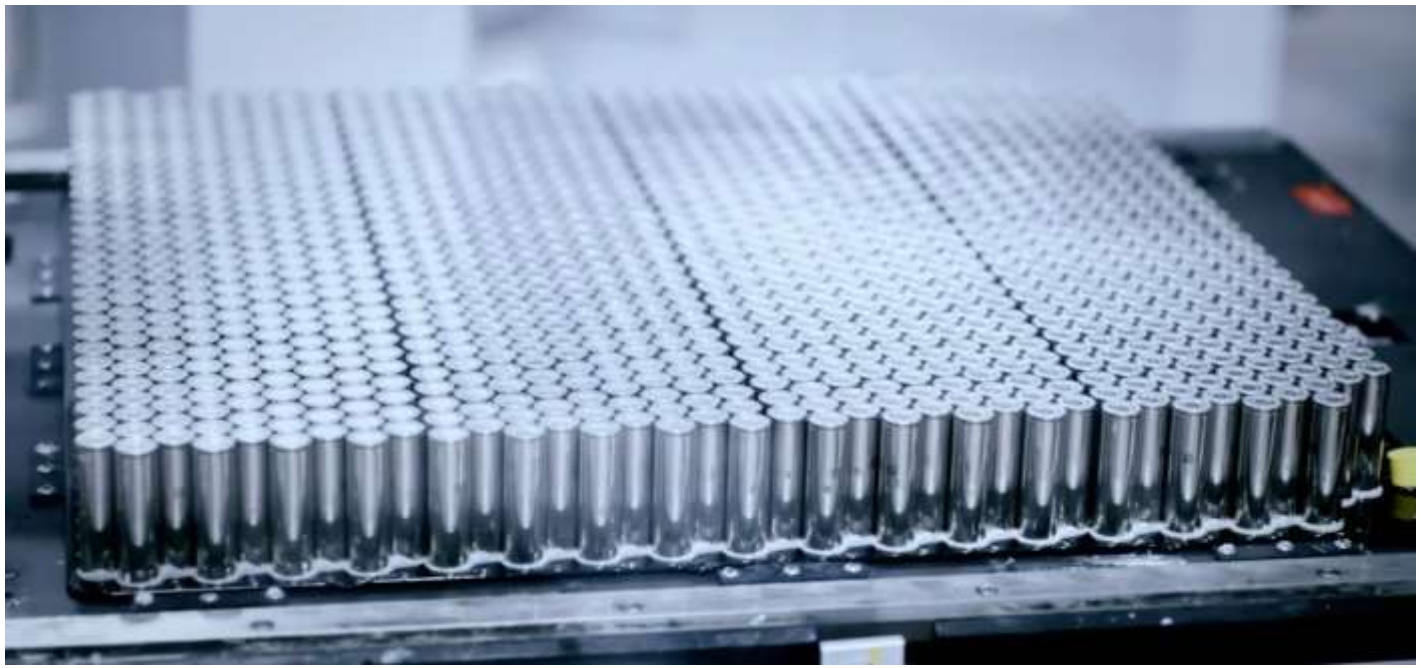


Battery Assembly

- Due to size, shape and to increase reliability batteries can be assembled in series and in parallel.



- Tesla use design to great effect, but requires thousands of battery cells, weighing up to 1000Kg and expensive to assemble.

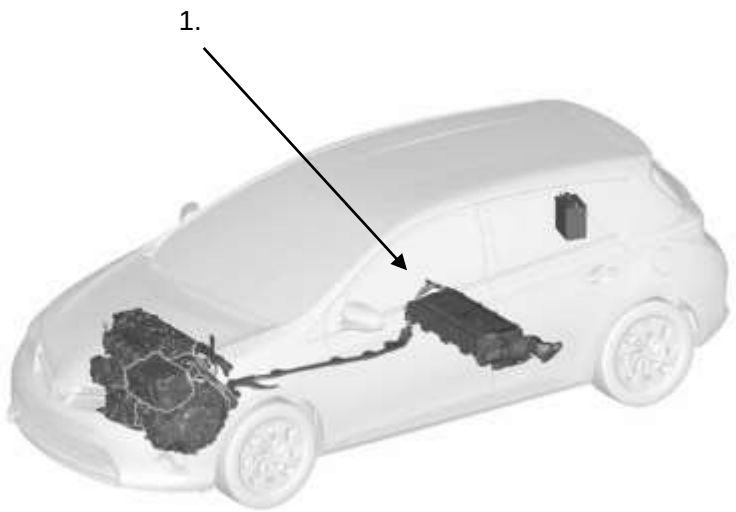


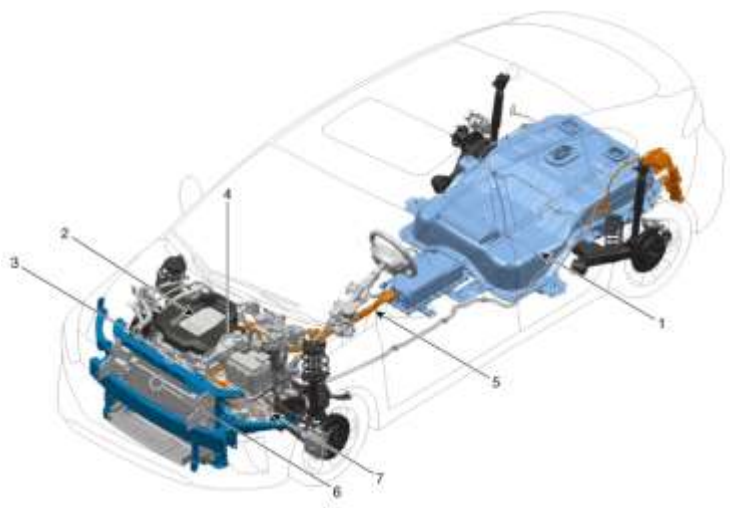
Battery Assembly

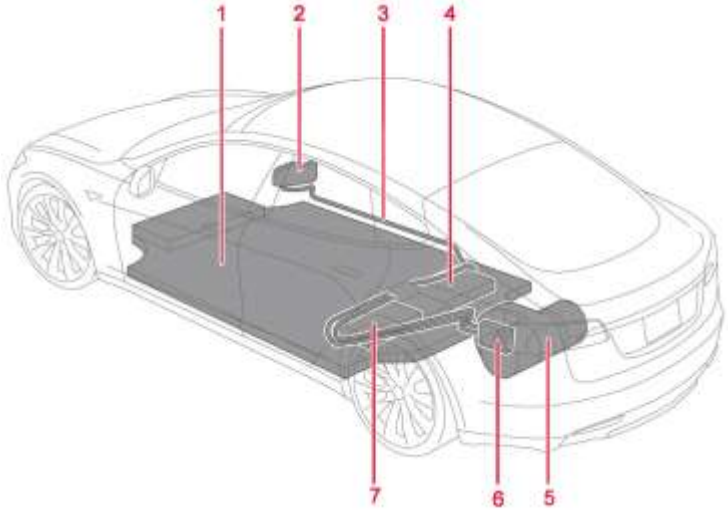
For a relatively small battery pack, installation is usually inside the vehicle*

For larger battery packs these are usually mounted underneath due to their size.

1. HV Battery location.







**See notes battery Assembly servicing*

Battery Assembly

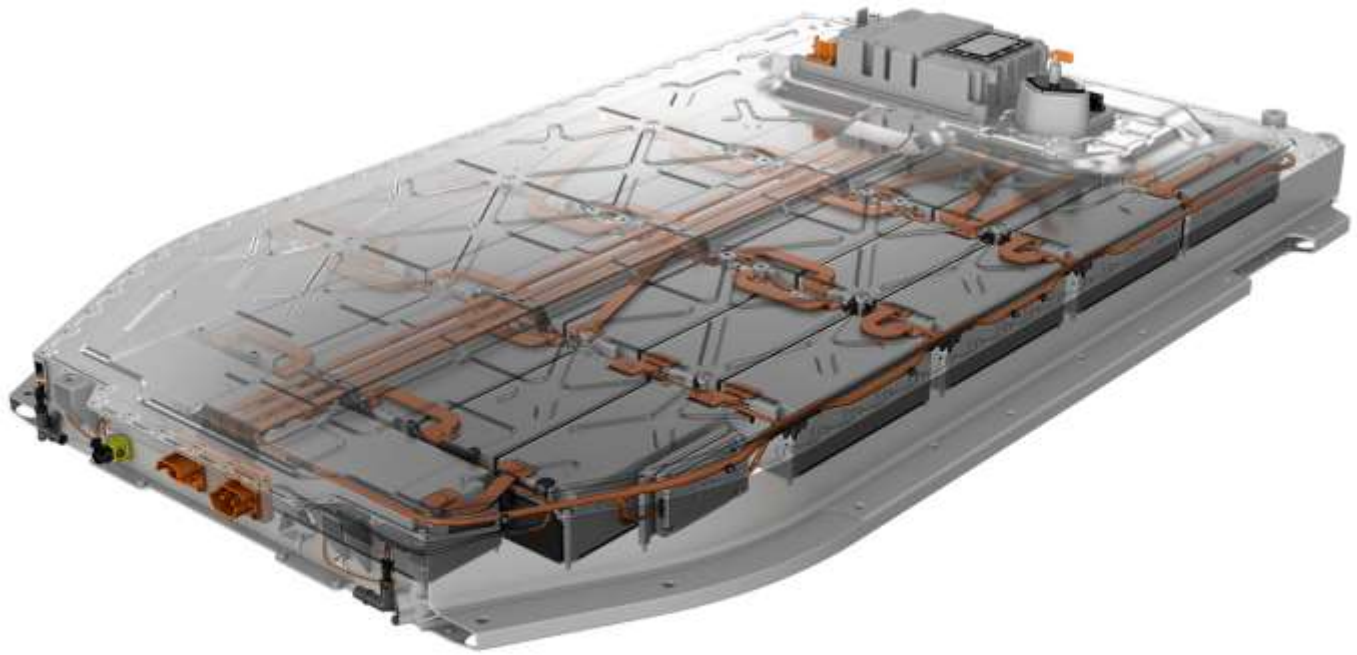
Notes and Servicing:

Ensure Air-Conditioning system is serviced yearly and in good working order:

- Minimising moisture build-up in battery assembly for air cooled batteries
- Air-conditioning system used to cool batteries

Ensure Cooling system is checked and serviced regularly:

- Cooling system used to heat and cool battery assembly



The Legal Stuff

Duty of care/responsibilities of staff and employers

The Legal Stuff….

In this module you will learn:

- The legislation regarding high voltages in the workplace.
- The employer's legal responsibility.
- The employee's legal responsibility.

The legislation

There are 2 main areas of legislation that affect the workplace and how we work on vehicles with high voltages:

- Health and Safety at Work Act 2005.
- Electricity at Work Regulations 1989.

Health and Safety at Work Act 2005

The Health and Safety at Work Act 1974 is the primary piece of legislation covering occupational health and safety in Great Britain. It's sometimes referred to as HSWA, the HSW Act, the 1974 Act or HASAWA. This was updated and re-issued in 2005.

- **It sets out the general duties which:**

- Employers have towards employees and members of the public
- Employees have to themselves and to others
- Certain self-employed workers have towards themselves and others
- Full details can be found here: https://www.legislation.gov.uk/ukpga/1974/37/contents.

Health and Safety at Work Act 2005

General duties of employers to their employees?

It shall be the duty of every employer to ensure, so far as is reasonably practicable, the health, safety and welfare at work of all their employees.

General duties of employees at work?

It shall be the duty of every employee while at work to:

- to take reasonable care for the health and safety of themselves and of others who may be affected by their acts or omissions at work

- as regards any duty or requirement imposed on their employer or any other person by or under any of the relevant statutory provisions, to co-operate with them so far as is necessary to enable that duty or requirement to be performed or complied with.

Electricity at Work Regulations 1989

Overview:

- The Regulations are made under the Health and Safety at Work Act 1974

(the HSW Act) reviewed and updated in 2005.

- Electricity at Work regulations aim to prevent death or injury to any person from electrical causes while working or in a work environment. This can include electric shocks or burns, electric arching and fires or explosions started or caused by electricity.
- The purpose of the Regulations is to require precautions to be taken against the risk of death or personal injury from electricity in work activities.
- Full details can be found here: https://www.hse.gov.uk/pubns/priced/hsr25.pdf.

Summary

- You and your employer are responsible for Health and Safety at Work.
- Your employer is responsible to make you aware of risks in the workplace regarding electricity.
- This may take the form of training, equipment and procedures.
- You are responsible for yours and others safety at work.
- Failure to do so, and resulting in injury may result in prosecution with fines and/or imprisonment.

What is Regenerative Braking/Self-Charging?

What's going on?

What is Regenerative Braking/Self-Charging?

Have you heard the terms used?

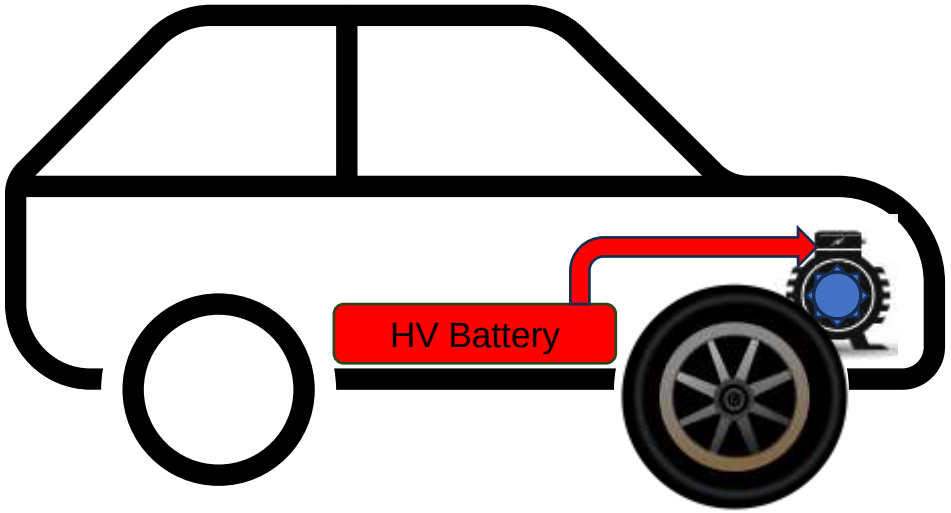
What's your interpretation?

How does it work?

How would you explain it to a client?

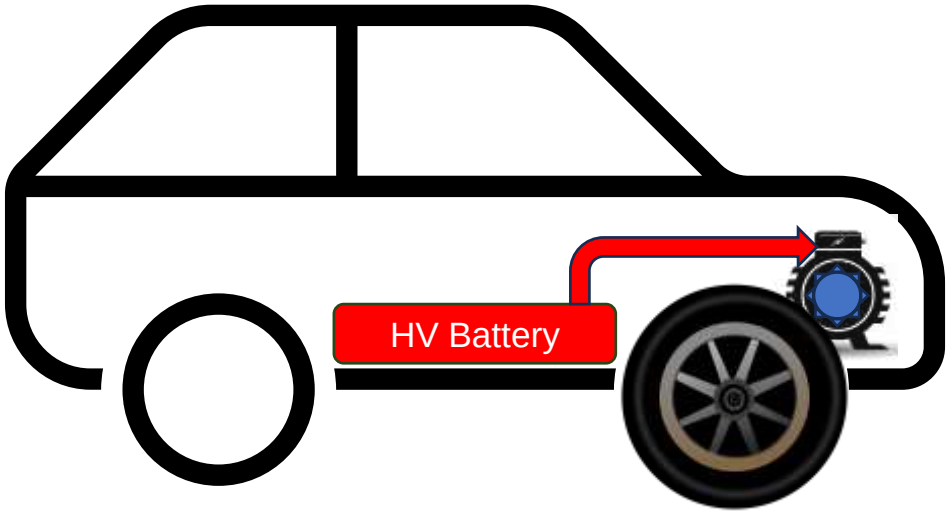
Regenerative Braking - Self Charging.

- Every electrically propelled vehicle is fitted with both a HV Drive motor and a HV generator. (Which is the same component)



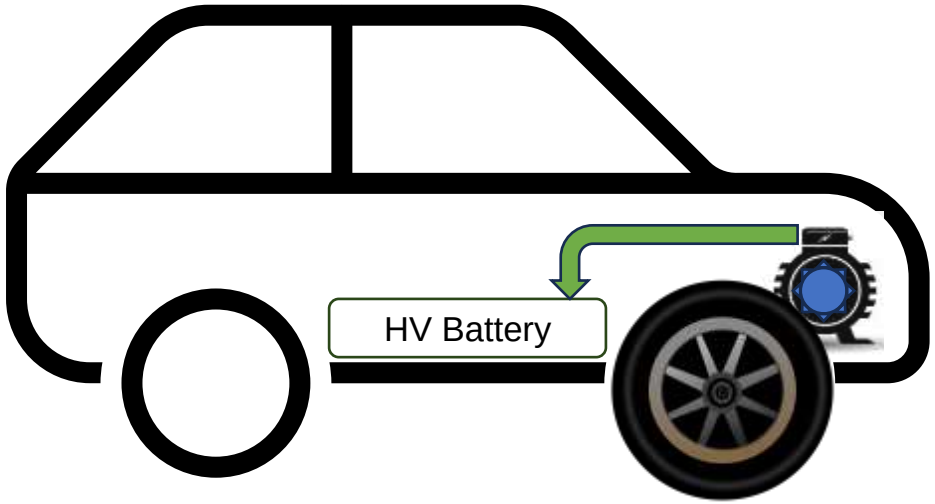
Regenerative Braking - Self Charging.

- When accelerating and cruising the HV motor propels the vehicle.
- This discharges the HV Battery.



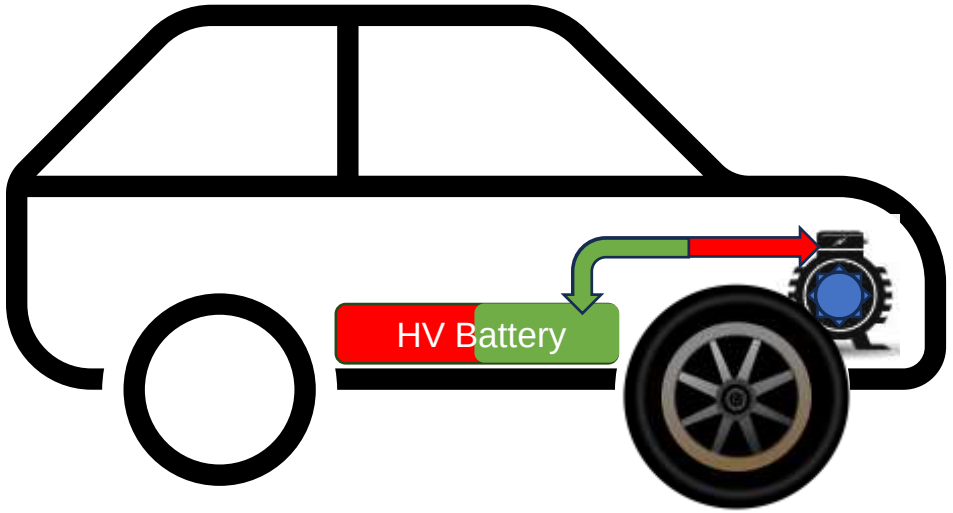
Regenerative Braking - Self Charging.

- When de-accelerating and/or braking the HV Motor acts as a generator.
- This recharges the HV Battery.



Regenerative Braking - Self Charging.

- The Motor and the Generator are the same component.



Regenerative Braking – Self-Charging.

What's the difference between the terms - Regenerative Braking and Self Charging?

Regenerative Braking Summary:

- Whenever deaccelerating or slowing down the generator will produce electrical energy
- This energy is used to recharge the HV Battery
- The conventional braking system works in parallel with the generator to slow the vehicle down
- Operational % between the braking system and generator is dependent on HV Battery state of charge.

Regenerative Braking – Self-Charging.

What's the difference between the terms - Regenerative Braking and Self Charging?

Self-Charging summary:

- All Electrically propelled vehicles self-charge
- HV Battery charging can only occur when plugged-in or deaccelerating
- Self-charging implies that the vehicle system can recharge the HV battery by itself – without plugging-in
- If not plugged-in, the only way to recharge the battery is from kinetic energy recovered when deaccelerating – 'Self-Charging'
- The term 'Self-Charging' can be misleading.

Charging Methods & Ways to Charge

Charging point types, types of charging leads, modes of charging & AC or DC charging

Charging methods

Charging Types

Charging Modes

Charging Cables

On-Board and Off-Board Charging

Charging types

There are 4 types of charging point available to charge an Electric vehicle:

- Type 1 & Type 2
- CCS
- CHAdeMO

These can be divided into two groups:

Type 1 & 2 - AC Charging

CHAdeMO and CCS - DC charging.

Charging types

- **Type 1 & 2 types. (AC Charging)**

Type 1

- 5 pin connector
- AC single phase charging
- Domestic & Commercial availability
- Mostly used for USA and Japanese market but early use in UK and European market.
- Maximum 7.4Kw capacity. (Slow charging)

Charging types

Type 2

- 7 Pin connector
- AC single or Three Phase charging
- Domestic & Commercial availability
- Introduced to the European market and now widely adopted for most markets.
- Maximum capacity for single phase 14.8Kw & 44Kw for three phase. (slow & Fast charging)

Charging types

CHAdeMO Charging

- Stand-alone DC Charging
- 10 pin connector.
- Developed for the Japanese and US market but early use in UK and European market.
- Only available commercially.
- Maximum capacity up to 400KW.
- Off-board charging (Fast/Rapid charging).

Charging types

Combined Charging System (CCS) Type

- Adaptation of Type 1 & 2 for DC charging.
- Additional 2 pins to facilitate DC connection.
- Only available commercially.
- Available in all markets.
- Maximum capacity up to 400KW.
- Off-board charging (Fast/Rapid charging).

Charging Modes

- **The different modes of charging.**
  - There are four modes for charging:
    - 1,2,3 & 4.
  - **Mode 1** is not normally adopted for charging modern vehicles
  - Mainly used for Caravans, Motorhomes and building site electricity supply
  - No communication protocol or control.

Charging Modes

Mode 2.

- Portable charging cable using an ‘In Cable Control Box’ - (ICCB)*
- Available for Type 1 & 2
- Made available to use from a domestic household 3-pin plug
- Not recommended as primary method of charging
- Limited to 3.2Kw (Slow).

****Not to be used with an extension lead – possible electrical overload***

Charging Modes

Mode 3

- Use with Electric Vehicle Supply Equipment (EVSE) charging point
- Either tethered or un-tethered
- Available for Type 1 & 2 connectors
- Available for Domestic & Commercial installation
- Capacity from 7.4Kw (Type 1/2) to 44Kw (Type 2) Slow - Fast.

Charging Modes

Mode 4.

Use with Electric Vehicle Supply Equipment (EVSE) charging point.

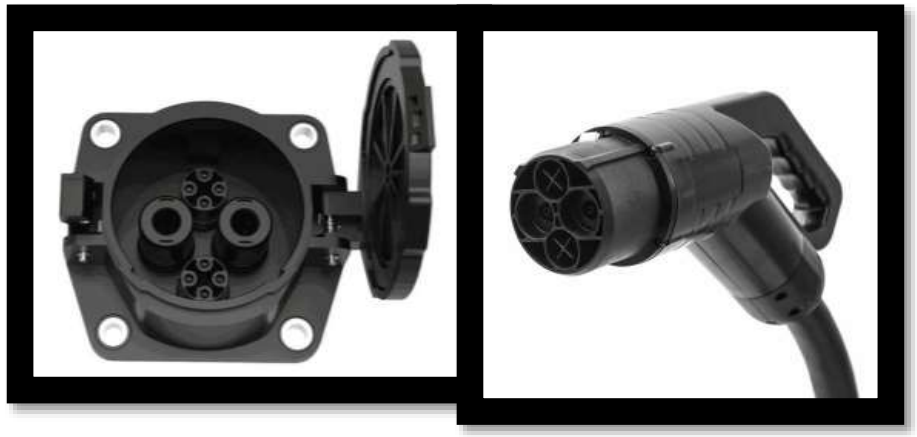
DC Charging only.

Only available commercially

CCS or CHAdeMO connection.

Tethered cable.

Capacity up to 400Kw.



Charging Cables

- **The different types of cable and their capacity**.

- **3 categories of cable:**

    1. In Cable Control box (ICCB)
    2. Untethered
    3. Tethered.

Charging Cables

In Cable Control box (ICCB) – domestic plug charging

- Used to access domestic 3-pin socket
- Type 1 or 2
- Limited to 3.2Kw (Slow)
- Not recommended for regular charging
- Due to load can overload supply – trip supply or vehicle stops charging*
- Technically should only be used on a dedicated supply – not part of the household ring main.

Not to be used with an extension lead – possible electrical overload

Charging Cables

Untethered

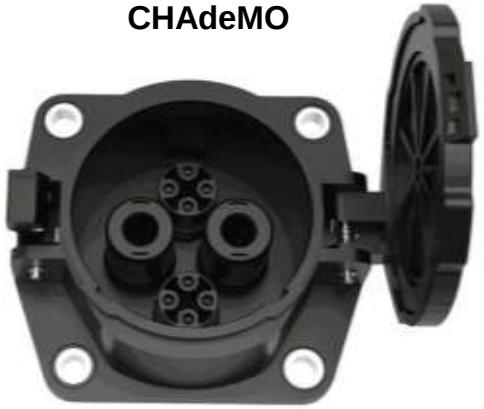
- Used with EVSE (Charge point)
- Either Type 1 or 2
- Single-phase (Type 1 or 2) - Domestic/commercial supply. (3.2 – 7.4Kw)
- Three-phase (Type 2 only) – Commercial supply. (up to 44Kw)
- Preferred choice of charging method
- Cable is rated to maximum load – check which cable is supplied with vehicle.
- Best choice is a three-phase cable – works with all available charge points

Charging Cables

Tethered

- Comes fitted to EVSE – Charge point
- Rated to output of EVSE
- Type 1, 2 AC or Type 2 CCS & CHAdeMO
- Usually, 3 phase with Type 2
- Type 2 CCS & CHAdeMO is DC charging – Vehicle may not have facility to DC charge. Check charge point on vehicle. See examples.

CHAdeMO



Type 2 CCS

On-Board and Off-Board Charging

The difference between on-board charging and off-board charging.

On-board charging

- All vehicles are fitted with on-board charging facility.
- On-board charging allows conversion of the AC supply from a ICCB lead or EVSE to DC for charging of the Vehicles' battery.
- Usually mode 3 - Slow/Fast/Rapid charging.
- Untethered or Tethered cable.

On-Board & Off-Board Charging

The difference between on-board charging and off-board charging.

Off-board charging

- Not all vehicles have the facility for off-board charging
- Off-Board charging allows DC supply from the EVSE directly to the vehicles’ battery.
- Usually mode 4 – Rapid charging
- Tethered cable only

Charging Methods & Ways to Charge

- Best ways to charge?
- What steps can be taken to get the best out of a charge?
- What steps can be taken to get the best range from a charge?

CUSTOMER RELATIONSHIP MANAGEMENT

Client qualification

Good qualification will lead to good customer confidence and loyalty

The Qualification process

Why is qualification important?

Give a good experience of qualification you recently enjoyed.

Give a poor experience of qualification you recently suffered.

What are the benefits of good qualification?

What are the consequences of poor qualification?

Different customer profiles

- Discuss in groups, the following customer profiles addressing the questions below:
- What questions do you need to ask to create an accurate customer profile?
- Any additional questions that you might add that would be important?
- What vehicle type would you recommend and why.
- Present back your findings to the other groups.

Different customer profiles

- **Example customer profile 1**

- Single female. (22 years of age)
- Professional occupation – Nurse.
- Lives at home with parents in large city.
- Is moving out to a flat.
- Has a small conventional ageing vehicle. No outstanding finance.
- Hobbies – swimming and mountain biking.
- Worried about charging availability.

Different customer profiles

- **Example customer profile 2**

- Retired Couple. (both in their late 60’s)
- Live in remote village.
- Own a large SUV conventional vehicle (3 years old). No outstanding finance.
- Hobbies – Travelling and visiting grandchildren 150 miles away.
- Concerned with charging whilst travelling.

Different customer profiles

- **Example customer profile: 3**

- Single male. Divorced (36 years of age)
- Professional occupation – Self-employed Project manager.
- Travels 30,000 miles a year for business across the UK.
- Lives in a 2-bedroom flat in a small town.
- Has two young children – sees them every other weekend.
- Has a medium sized Hybrid vehicle (4 years old). Privately owned but used for business. Leased.
- Hobbies – Football, supports a Premier league team. Likes to take his children to the football matches

Different customer profiles

- **Example customer profile 4**

- Young couple. (29 & 31 years of age)
- Occupations – Construction worker/Hairdresser.
- Live in a new property recently purchased.
- Own a small ageing conventional vehicle and a light commercial vehicle (5 years old). No outstanding finance.
- Looking to start a family in the next couple of years.
- Hobbies – Cinema, eating out and city breaks.

Different customer profiles

- What type of customer profiles can there be?
- In groups discuss and collate to create different types of customer profiles you've come across.
- Present back your results.

Managing the customers' expectations and requirements.

Customer perceptions of electric vehicles.

Common objections and anxieties:

- What other objections, perceptions and anxieties can you think of?

- Battery will explode
- Range not good enough
- Too expensive
- Nowhere to plug it in
- Environmental impact of battery production and disposal.

Managing the customers' expectations and requirements.

How would you overcome these objections, perceptions, and anxieties?

- In groups choose 1 objection/perception/anxiety and work on responses that overcome them.
- Feedback and discuss to the other groups your solutions.

Additional Considerations

Low Emission Zones?

- Which cities have low emission zones?
- LEZ/ULEZ (emission zones) compliant?
- Check your vehicle:

https://tfl.gov.uk/modes/driving/check-your-vehicle/

Additional considerations

- **Charging.**
  - **Does the customer have access to residential charging?**
  - **Can the customer have a property suitable for installing a charger?**
  - **Is there charging available at their place of work?**
- **Congestion charges**
  - **Does the client live in a congestion charge Zone?**
  - **Will they travel to a congestion charge Zone?**
  - **Can the savings contribute to the financial decision on which vehicle to consider?**

Additional considerations

- Environmental
  - Does the customer have a strong environmental motive?
- Financial
  - Is there BIK advantages to consider? (Company use)
  - Road Fund licence advantages?

Customer Relationship Management

- How can we improve the customers experience of switching to an Electrically Propelled Vehicle?
- Customer handover – what should you do differently?
- What are the hidden benefits?

Finally!

Common issues with owning/using an Electrically Propelled vehicle…….

Thank you