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Step 2 –
Explore alternative fuels and technology types
a) cars & vans

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ALTERNATIVE FUEL OPTIONS

Source	Available	Pro	Con	The near future
Natural gas	Limited in most countries	Fuel available from secure regions / can be biogas	Produces (less) CO2 and AQ	Used for heavy vehicles and light vehicles in some countries
Biofuels	Limited in most countries	Lifecycle emissions low	Concern over food security	Used for heavy vehicles and light vehicles in some countries
Electricity	Limited	Potentially zero emission	Power stations produce CO2	Used for light vehicles / short duty cycles

Clean Buses: Experiences with Fuel and Technology Options

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1.2: ALTERNATIVE FUELED CARS AND VANS

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ALTERNATIVE FUELED CARS AND VANS

- EU legislation

- Cars: 2015 fleet average = 130g CO_2/km
  - 2021 fleet average = 95g CO_2/km

- Vans: 2017 fleet Average = 175 g CO_2/km
  - 2020 fleet average = 147g CO_2/km

ZeRO TAXI, Mitsubishi i MiEV taxicab in Tokyo CC BY-SA 3.0

- Meeting these target is only achievable with significant market penetration of electric vehicles

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WHAT IS AVAILABLE

Technology	Car	Vans
Petrol	✓	✓
Diesel	✓	✓
Hybrid	✓	After market conversion
Plug in hybrid	Medium (C, D and SUV segment)	X
Range Extended electric	Small and medium (B and C segment)	X
Electric	✓	OEM small vans and Aftermarket conversions
Gas	In some countries	In some countries
Biofuel	In some countries	In some countries
Hydrogen	X	X

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GENERAL RULES FOR PETROL AND DIESEL (ICE)

- Diesel vehicles are cheaper than petrol over their lifetime
- Petrol vehicles produce more CO_2 per Km than diesel vehicles
  - Ford Focus – Diesel 88 g CO_2/Km vs petrol 109 g CO_2/Km
- Petrol vehicles produce less air quality associated emissions
  - Ford Focus – Diesel NO_x 146 mg/Km vs petrol 32.8 mg/Km
- Petrol vehicles are more suited to urban, stop start driving and diesel vehicles are more suited to out of town driving, at constant speeds.

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GENERAL RULES FOR HYBRID VEHICLES

- Little difference between this and an ICE vehicle
- A stop gap between conventional fuelled and electric vehicles
- They produce slightly less CO_2 emissions than conventional petrol car
  - Toyota Prius = 89g CO_2/Km vs Ford Focus = 109g CO_2/Km
- A smaller car could be more appropriate
  - Toyota Prius = 89g CO_2/Km vs Fiat 500 = 90g CO_2/Km
- A diesel car could be more appropriate for non-urban driving
  - Ford Focus diesel = 88g CO_2/Km

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GENERAL RULES FOR ELECTRIC VEHICLES

- Vehicles run exclusively on electricity
- Advertised range of up to 160km, assume 60% of this
- Vehicles can be more expensive to purchase, but cheaper over the lifetime due reduced running costs
- Batteries are often leased rather than purchased – price is then similar to an ICE
- The operators have to be trained to plug the vehicle in after every journey
- Can be very suitable for use as a pool car, with a management system in place
- Most charging is likely to happen at ‘home’, many vehicles charging at the same time can require significant grid upgrades = costs.
- At present few countries have a recharging network which can be relied upon. At present only Estonia does.

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GENERAL RULES FOR PLUG IN HYBRID AND RANGE EXTENDED VEHICLES

- Vehicles have an engine and a rechargeable battery.
- It is possible to use the vehicle almost exclusively as an electric vehicle, the engine can cut in if the battery runs out.
- The all electric range for a plug in hybrid is approximately 15km
- The all electric range for a range extended electric vehicle is 40-160km
- The vehicles are more expensive than a conventional ICE, but savings can be cheaper over their lifetime
- The operators need to be trained to plug the vehicle in as often as possible to ensure it runs on electricity as often as possible
- If the vehicle cannot be plugged in often, an ICE vehicle should be purchased instead
- If the engine will not be used an electric vehicle should be purchased instead

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GENERAL RULES FOR GAS AND BIOFUELED VEHICLES

- These vehicles are similar to a conventional ICE vehicle but use alternative combustible material
- Biofuels come from various renewable sources, including crops and waste.
- Gas is the same as domestic gas, which is compressed (CNG). Gas can also come from renewable sources (biogas/biomethane)
- Dedicated refuelling infrastructure is required. At present there is a limited number of countries with this.

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GENERAL RULES FOR ALTERNATIVE FUELS VEHICLES

- Subsidies exist for some of these technologies
- Look at both leasing and purchasing.
- You may need to challenge existing funding mechanisms
- You may need to challenge current vehicle operation systems to allow for the different fuelling or charging regimes
- Alternative fuelled vehicles sometimes need to be driven a lot to be cost effective

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b) heavy duty vehicles