

Futureproof: Are electric cars the answer to our problems?

Intro -

Is the world ready for electric cars and will it really be the greenest option?

In this essay I will look at how climate change has affected the way we live and how the introduction of electric cars is seen to be the 'holy grail' in saving the planet. Additionally, this paper shall look at whether electric cars will be ready for the big rollout in 2030 and also the other factors which will need to be realised - such as infrastructure, cost, ease of use in rural areas and availability of charging points. According to Van Mierlo & Maggetto (2007), Electric cars are a long term vision and are ready to take over the diesel and petrol use of cars. However, they also state that the designers need to emphasise and take strong action in the short and medium terms for the current environmental and energy problem. (J. Van Mierlo, G. Maggetto, 2007)

This issue needs to be addressed as soon as possible because if the environmental problems aren't resolved quickly enough there could be more problems in the future leading to being unable to deliver electric cars. As it has been stated the commission's Nover 200 Green Paper on the security of supply have stated that in 1998, the transport was responsible for 28% of emissions of CO₂ in the atmosphere. In the future it will increase to around 50% if nothing has been invested and invented in the transport area. (J. Van Mierlo, G. Maggetto, 2007)

According to Linde (2010), Environmentalists, politicians and manufacturers have gathered up and agreed on one thing, that electric cars are for the future. According to Linde (2010), there are many stats that will back up this information.

The report also states that electric cars can save you up to 85% on fuel bills. This is because for every 1 kWh in the UK, it is on average 10p to charge, which can allow you to travel far away as well for a lot less compared to diesel/petrol cars. However, there are things to be wary of with electric cars. The price of a new battery for an electric car would cost the same as buying a used electric car, which may put people off buying them in the short term, with prices surely to decrease as more people move over to electric models. (A. Linde, 2010)

Linde also predicted that by 2020, they will have 100,000 electric cars available in the UK which has not only been achieved but surpassed and doubled. This is because in 2021, there were 245,000 pure-electric cars on UK roads at the end of April 2021, and over 515,000 plug-in models including plug-in hybrids. (C. Lilly, 2021) Electric cars emit zero-emissions into the environment which is good, especially since we are facing a major problem with our greenfoot environment and vehicles are responsible for a big part of it. However, it is still using fossil fuels to produce electricity for your car to drive. Unless you used green energy sources such as wind, or solar panels (A. Linde, 2010).

Infrastructure

Although the focus for many is the cars themselves, the more pressing problem is now the infrastructure required to keep them on the road. Without details of legislation or policies, we cannot say how the government proposes to create the charging network that will be required, or indeed where the burden for providing it will fall. What we can say is that such a network must now become an urgent infrastructure priority. (openaccessgovernment.org)

The page by openaccessgovernment.org also states that as of August 2019, there were already 9,199 electric vehicle (EV) charging stations across the country. That compares to 8,396 standard fuel stations. However, this is for what is still a fairly niche market. Many of those charging stations will be for a homeowner with sufficient private land on which to park and charge their car.

In high-density residential areas, it is simply not feasible for every property to have cables running from their electricity supply to their vehicle. National Grid points out that with 20 million EVs on the road there will be at least 8.6 million vehicles that will not have the facilities for at-home charging.

Public charging stations will, therefore, be needed. Owners of petrol and service stations have already installed a number of charging points; and there have been some more creative solutions suggested. For example, using lamp posts that now have spare capacity from switching to LED bulbs, or commandeering other street furniture such as Virgin Media's street cabinets. Imaginative though this is, it can only form part of the answer to the challenge. (Linde. A, 2010)

Climate Change

The Intergovernmental Panel and Climate Change (IPCC) has stated that it is "code red for humanity" as there are far too many fires everywhere world wide, and too many people leaving because of the fire. Sea levels have been rising a lot more every year as it goes along as the global climate gets warmer over time. The world is at its hottest point since 1850. (M. McGrath, 2021)

With scientists stating that without emissions being cut in half by 2030, the heat will only intensify and sea levels will rise causing more flooding to coastal towns and affecting the lives of millions of people worldwide. (M. McGrath, 2021)

This is why the introduction of electric cars could be pivotal with the reduction of greenhouse gases leading to some recovery in the earth's atmosphere and potentially returning the earth's temperature to a more manageable level.

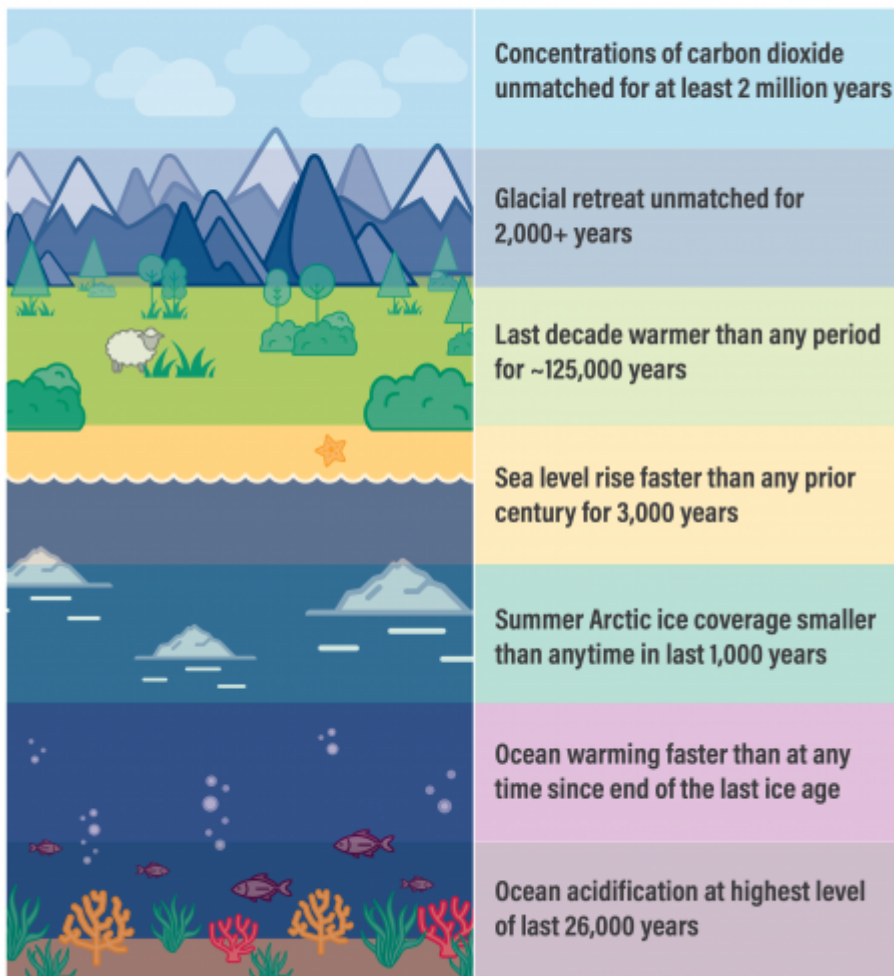
However, this is only achievable with the support of all countries and not just a select few. Is it achievable? Yes. Is it likely to happen by 2030? Sadly, it is unlikely unless many countries change their attitude to global warming and climate change.

"Is it still possible to limit global warming to 1.5 °C? The answer is yes," says Maisa Rojas, a lead author on the report and director of the University of Chile's Center for Climate and Resilience Research in Santiago. "But unless there are immediate, rapid and large-scale reductions of all greenhouse gases, limiting global warming to 1.5 °C will be beyond reach."

According to nature.com (2021-13-08) Earth's global surface temperature has increased by around 1.1 °C compared with the average in 1850–1900 — a level that hasn't been witnessed since 125,000 years ago, before the most recent ice age. "The evidence is everywhere: if we don't act, the situation is going to get really bad," says Xuebin Zhang, a climatologist at Environment Canada in Toronto, Ontario, and a lead author on the report, released on 9 August 2021.

Explaining the 2021 IPCC Report

Evidence of Global Warming Already Underway



Source: IPCC.
2018-09

From the IPCC report, there are numerous points about the dangers of the climate we are currently living in. The main five findings about climate change are quite shocking, but the people on earth have vastly over produced Carbon Dioxide emissions compared to two million years ago. The report also shows that glaciers are at their lowest point for over two thousand years and it is showing no signs of slowing down.

The temperature of the atmosphere is at its hottest for 125,000 years meaning that over the years, sea-levels have been rising as the glaciers are still melting due to the temperature of the environment. (K. Levin, et al, 2021)

A way this issue can be resolved sooner is if the more developed countries help out the poorer nations as promised. According to wri.org (14-08-2021) It's been more than a decade since countries party to UN-led climate negotiations agreed to an annual goal of \$100 billion per year by 2020 to support developing nations' climate adaptation and mitigation efforts. Those commitments have fallen short. In 2018, the most recent year for which data is available, total climate finance mobilised hovered just under \$80 billion - clearly the big nations are not offering the support needed to tackle this ever increasing problem.

Anticipating the future under the influence of climate change is one of the most important challenges of our time, and the topic of the special section in this issue of Science. The natural systems that provide oxygen, clean water, food, storm and erosion protection, natural products, and the potential for future resources, such as new genetic stocks for cultivation, must be protected, not just because it is part of good stewardship but also so that they can take care of us. But even the first step of modeling the effects of greenhouse gas sources and sinks on future temperatures requires input from atmospheric scientists, oceanographers, ecologists, economists, policy analysts, and others. The problem is even more difficult because the very factors that influence temperature changes, such as ocean circulation and terrestrial ecosystem responses, will themselves be altered as the climate changes. With so many potential climate-sensitive factors to consider, scientists need ways to narrow down the range of possible environmental outcomes so that they know what specific problems to tackle. (K. Levin, et al, 2021)

In recent days there has been a joining of world leaders to discuss future proofing the world against dramatic climate change (COP26). One of the discussions was about bringing forward the proposals for zero-emissions and it was time for "emergency response" (www.ukcop26.org).

COP26.org said that there were many encouraging announcements from the conference and one of the biggest was that "leaders from over 120 countries, representing about 90 per cent of the world's forests, pledged to halt and reverse deforestation by 2030, the date by which the Sustainable Development Goals (SDGs) to curb poverty and secure the planet's future are supposed to have been achieved".

According to this report, the UN Chief has pledged \$100 billion to the climate finance commitment which is a big input, however the outcome and realisation of many is that, is the travel of all these world leaders necessary? We are living in a world where many have had to get used to 'remote working' during COVID times. Surely to help push the 'greener world' message, all delegates could meet remotely - saving millions of pounds and the air pollution will be dramatically reduced.

What they're doing at moment

Emissions from the transportation sector are significant contributors to climate change and health problems because of the common use of petrol vehicles. Countries in the world are attempting to transition away from petrol vehicles and to electric vehicles (EVs), in order to reduce emissions. (Tran, M.K. et al, 2021) A promising alternative to the current vehicles are electric vehicles (EVs) (Panchal, S. et al, 2020). In the past, there was resistance toward electrification of vehicles due to performance and costs. However, as time passes by, and with more research and development effort being put into EVs, vehicle electrification is currently considered an inevitable part of the future. EVs use a motor, powered by a lithium-ion (Li-ion) battery pack, to propel the vehicle (Tran, M.-K. et al, 2020). Li-ion batteries are used due to their long lifespan, high energy density, high power density, and environmental benefits (Mevawalla, A. et al, 2021). EVs have lower environmental and health impacts because they do not directly release any emissions of pollutants (Tran, M.-K. et al, 2020). Therefore, EVs can help prevent climate change and protect public health (Tran, M.-K. et al, 2021). EVs also play an important role in the development of smart cities in the future (Lai, C.S. et al, 2020). However, due to the lack of available charging infrastructure, the long charge time, the high cost of long-ranged EVs, and the limited range of affordable EVs, there exists a range anxiety issue that hinders the expansion of EVs. Range-extended EVs (REEVs) are seen as a potential solution to the limited range and high cost of EVs. A range extender is an auxiliary power unit (APU) that provides the vehicle with additional energy to complement the primary battery in propelling the vehicle (Husain, I. 2011). According to the 2012 Amendments to the Zero Emission Vehicle Regulations, a range-extended battery EV should comply, among others, with the following criteria (J. Voelcker, 2013):

The vehicle must have a rated all-electric range of at least 120 km.

The APU must provide a range less than or equal to the main battery range.

The APU must not be switched on until the main battery charge has been depleted.

The vehicle must meet the super ultra-low emission vehicle (SULEV) requirements.

The APU and its associated fuel must meet the zero evaporative emissions requirements.

Is it working well?

According to Hlar (2021) there are several practical limitations with EVs, one of which is the “range anxiety” issue, due to the lack of charging infrastructure, the high cost of long-ranged EVs, and the limited range of affordable EVs. One potential solution to the range anxiety problem is the use of range extenders, to extend the driving range of EVs while optimizing the costs and performance of the vehicles. Recently, worldwide there has been a big issue with supplying certain parts for the electric cars to be manufactured, “The shortage is a result of pandemic-related constraints on supply chains and other factors. And it could prolong the world's sluggish transition to electric vehicles if chips remain scarce in the coming months, experts say”. This suggests that due to missing certain parts, the electric cars sale worldwide will be much slower than it expected to be. The revised date for the rollout may now be hard to achieve due to the delays in getting the ‘chip’ to all car manufacturers in time. (Hlar. C, 2021)

The most recent statistics show that there are 5.6 million electric vehicles worldwide — a staggering 64% increase (2.2 million EVs) from 2018 saw the total number of EVs rise from 3.4 million to 5.6 million. (John Voelcker, 2013)

In a recent study (Kopestinsky. A, 2021) it was shown that the top four electric car sales are; 1. Toyota Camry 2. Honda Accord 3. Honda Civic 4. Tesla. The fact that Tesla wasn't the number one best-selling EV despite being the ‘iconic’ electric car is quite an interesting one. (Kopestinsky. A, 2021)

Electric Vehicle Sales By Year

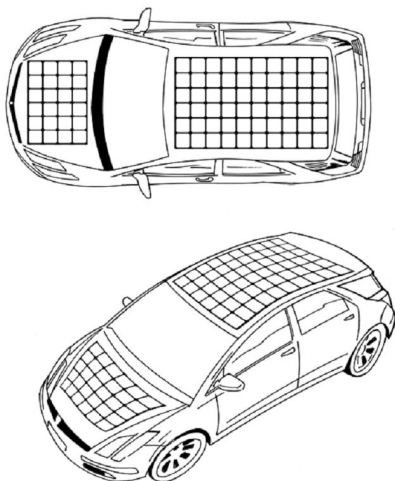
	2015 (Units)	2016 (Units)	2017 (Units)	2018 H1 (Units)	2019 H1 (Units)
China	190,000	351,000	606,000	388,000	645,000
Japan	25,000	22,000	56,000	27,000	23,000
Europe	196,000	222,000	308,000	194,000	261,000
USA	115,000	157,000	200,00	122,000	149,000
Other	20,000	23,000	55,000	44,000	55,000

Improvements

Currently most cars have Range Anxiety, but there have been many problems with it. The main issue is the transport to places as it has low mileage in it and needs to be charged more often. The alternative plan for the future is to use Range Extender as it is a cheaper option than the Range Anxiety, including “high efficiency, high power, and energy density, established fuel infrastructure, simple design, easy and flexible packaging, good scalability, low noise and vibration, low emissions, and long service life.” It is an ideal replacement and improvement in some criteria for electric cars over Range Anxiety, but there is still need to be more research into it as it is a very new advance technology so need research on improving some area in it before publishing and introducing the new technology to be input in the electric cars. (Stevic & Radovanovic, 2012)

According to Zoran Stevic and Ilija Radovanovic (2012), they have considered some other ways of improving electric cars for the future. One of the possible ways of saving electricity is through braking of your cars when you slow down, the use of waste heat energy such as from the engine of the cars, or the rubber from the wheels. Using solar cells such as this could mean designing a solar panel that goes on top of the car as a roof of the car or on top of the bonnet. Improving the mechanical function of the cars and improving the car shells design through a more streamlined design so the car can use the wind energy for electricity. (Stevic & Radovanovic, 2012)

Another way to generate electricity instead of plug in is to use solar panels on the exterior of the cars to generate energy. However, this is still in the development stage and it could be used alongside plug-in options in a ‘hybrid’ type version that exists now with petrol and electricity cars. (Stevic & Radovanovic 2012)



Another concept that has been developing and improving over the years is the kinetic energy recovery system, which is also known as “KERS”. It is an automotive system that recovers energy under braking and then is stored in a reservoir which is then used under acceleration. (Stevic & Radovanovic, 2012)

In addition, there is a concept linked to EVs which has been in progress in building a 'smart road' which has a charging input under the road. So when the car is moving the charging points under the road will keep maintaining the electricity in the car. It has been started in the UK with it's first road being built on part of the M4 stretch near London. (Highways England, 2015)

3rd Para

- ***futureproofing (infrastructure, cost, availability, battery life, noise pollution, electricity costs going up due to lack of tax on petrol/diesel?***

According to Oliver Smith at bbc.co.uk, there has recently been a short crisis in petrol limitation nationwide due to lorry driver shortages. Oil company BP has temporarily suspended use at some of the petrol stations causing panic for everyone. Causing a lot of problems such as long queue waits, a limit on petrol you can fill. This could have a knock on effect and lead to potential job losses.

Hydrogen Fuel Cell Cars	
Pros	Cons
▪ Greenest power source ▪ Use of renewable energy ▪ Efficient power source ▪ Quiet means of transportation ▪ Short fueling time ▪ Long range ▪ No harmful fumes ▪ No air pollution ▪ No greenhouse gas emissions ▪ Perfect for commuting ▪ Hedge against increasing gas prices	▪ High costs for new cars ▪ High depreciation in the first years ▪ Charging may be an issue ▪ Lack of infrastructure related to hydrogen cars ▪ Limited selection of vehicles ▪ Technology not mature yet ▪ Large investments in R&D necessary ▪ High fuel costs ▪ Safety concerns ▪ Hydrogen production may not be eco-friendly

There has been a recent drive in the development of hydrogen cars being produced in Germany and renowned companies such as BMW, Volkswagen, and Audi have put billions into the development of Hydrogen fuel cells cars. However, as the table above shows, There are still as many questions than answers about the development of Hydrogen Fuel Cell Cars. (Andreas, 2021)

According to Andreas from Environmentalconscience.com, the positive of using hydrogen fuel cell cars is that it is the greenest power source because it is not produced by any kind of fossil fuel, in contrast to that of electric cars. So hydrogen cars can "play a crucial role in the next decades and may also become a suitable

alternative to electric vehicles.” (environmentalconscience.com)

Another positive would be the use of renewable energy as it is made by extraction from water. It is a fully renewable energy and it is the shortest in terms of time refilling the fuel in the car. In contrast, electric cars take up to 30 minutes to fully charge.

Hydrogen cars have a longer range before the need to refuel. The average is 300 miles before the need to refuel. There is no harmful fumes and air pollution being produced by Hydrogen fuel cells. Thus, considering the global warming problem, hydrogen is a good option to go for as it is not being used by any fossil fuels at all.

The negative side of using Hydrogen is the lack of infrastructure related to hydrogen vehicles as it has only been developed recently. The charging of hydrogen fuel could be dangerous as it is flammable and there aren't a lot of charging stations currently available. This is the same situation with electric vehicles as it is a new type of vehicle power that is being brought into our world.

The technology of the hydrogen fuel cell isn't mature enough yet. As it is a new technology, it can be vulnerable. But as time goes on within the improvement of technology and knowledge of the hydrogen fuel cells it'll be much more stable and reliable to use. The cost of using a hydrogen fuel currently is more expensive than gas and electric so there is a large investment required into hydrogen vehicles as it is a potential alternative electric cars. (Andreas, 2021)

According to a group on www.youtube.top-Electric, The process of getting hydrogen produced is producing large amounts of carbon dioxide and carbon monoxide. It is also using a lot of energy which makes it extremely expensive. Therefore, just producing hydrogen is damaging the environment. But with the increase of renewable energy coming along this should exceed the small amount of carbon footprint that is being produced compared to those made in a factory.

Current electric deals - are they sustainable?

The UK Government's Plug-in Car Grant, which will pay for a maximum of 35% of the purchase price of the vehicle, up to £2500, for EV buyers, is an incentive to get more people to buy EVs now and not in 10 years time. (whatcar.com)

EDF energy also has an incentive where if the consumer buys into their electric product when they buy a car, they receive the first 10,00 miles completely free - effectively one year's worth of driving for no charge. (edfenergy.com)

Experts at Confused.com stated without “support from manufacturers”, prices have been more likely to “go up”. The feedback comes after a report from Transport & Environment exhibits UK manufacturing is not going to maintain tempo with the remainder of Europe.

This means households should change to electrical vehicles in the event that they wish to buy a model.

It stated: “Many of us are on board with efforts to turn out to be extra environmentally aware.

“In fact, we found that more than half (56 percent) of motorists would consider buying an electric vehicle as their next car.

“If we’re to reach the 2030 ban on new petrol and diesel cars, we need to see the support from manufacturers and the government alike, as a reduced supply from manufacturers could mean costs go up on EVs in the UK.

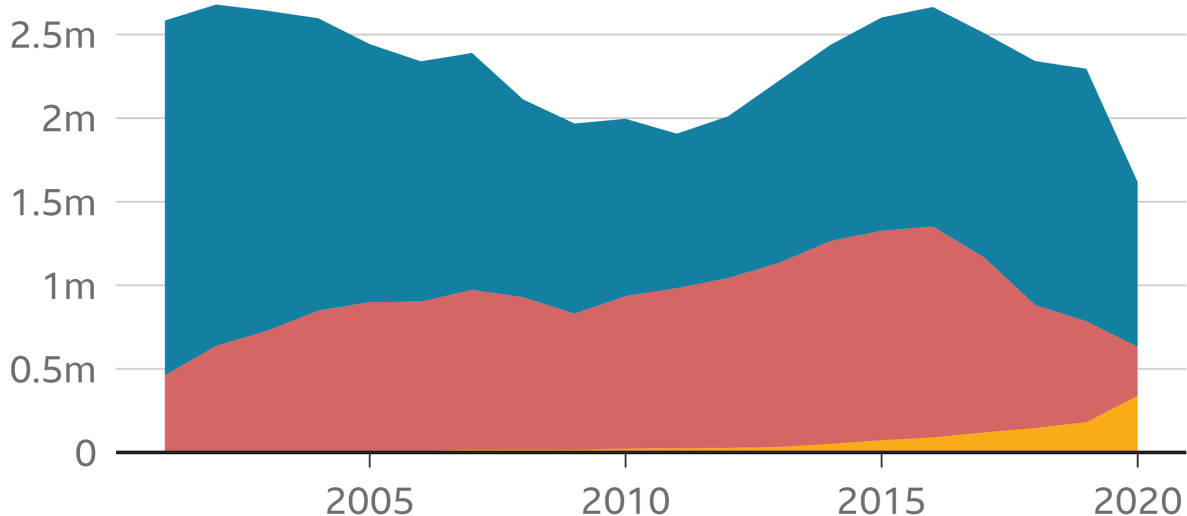
“With the ban fast approaching it can be confusing to know when is the best time to make the switch.

“Especially when considering high price tags and news of changing UK supply adding an extra level of anxiety.” (www.uk.newschant.com)

Number of electric cars is small, but growing

Cars registered for the first time in Great Britain, by fuel type

■ Petrol ■ Diesel ■ Electric



Note: Electric includes hybrid, plug-in hybrid and battery-powered cars

Source: Department for Transport

BBC

As the graph shows, the demand for electric cars is increasing and this will surely only get steeper the closer we get to 2030. This is unless hydrogen or any other carbon neutral resource are able to throw their hat into the mix and lead to electricity having to do more to not have a monopoly of the market. (www.bbc.co.uk)

Another area where we will notice change relates to noise: As well as boasting zero exhaust emissions, electric vehicles are far quieter than diesel and petrol cars.

This means less noise pollution in urban areas — clearly a good thing — but also throws up a potential challenge for other road users, especially those with sight problems.

“For people who are blind or partially sighted, judging traffic can be really difficult,” (CNBC.com, 2021).

The report also explained that an increasing number of “quiet” modes of transport were now being used, giving the example of bicycles and larger electric and hybrid vehicles.

“If you can’t always or reliably use vision to detect those vehicles, then sound is even more important,” it went on to state. And when the sound is not there, or is not loud enough to be able to reliably detect those vehicles, obviously that presents danger because ... you’re not reliably able to know when a vehicle is approaching you.” (CNBC.com, 2021)

Conclusion

Recently, a minister from the COP26 meeting the ZEVTC (Zero Emission Vehicle Transition Council) announced that they wanted to make sure that the ZEV is truly global and they will launch their planned strategies to ensure that no countries around the world will be left behind. (UKCOP26.org)

Their promise stated that they will:

- continue our engagement with developing countries through Regional Dialogues to consider how practical collaboration can overcome region-specific barriers to an accelerated transition to zero emission vehicles
- bring together a taskforce of government officials, multilateral development banks, international organisations and other stakeholders, as required, to:
 - coordinate a more tailored, impactful, and effective offer of development assistance, including via existing programmes / initiatives, to support the deployment of zero-emission vehicles and relevant infrastructure in developing countries; and
 - provide evidence-based and action-focused recommendations to the ZEVTC on how and where the international offer can be strengthened. Recommendations will be based on experiences and outputs from the Regional Dialogues and wider programmes / initiatives

(UKCOP26.org, 2021)

Both Electric and Hydrogen powered vehicles have pros and cons. However, from the text it is shown that EV’s have lots of benefits from zero-emissions due to not using any kind of fossil fuel being produced. However, to charge the electric cars is a major problem due to if too many people charge overnight at the same time it could cause major issues due to the national grid not being powerful enough.

Hydrogen powered vehicles have no greenhouse gases being polluted in the

atmosphere and it is a renewable energy source and power source. But there is a lack of infrastructure to support it as Hydrogen has had less research placed upon it due to it being a newer form of energy for vehicle power.

Referring back to “Are electric cars the answer to our problems?” It seems, based on all the research gathered that this answer is no.

Despite all the obvious positives and apparent readiness by many world leaders for electrical powered vehicles, there is still a long way to go in providing assurances in regards to infrastructure with matters like the demand on National Grid in the UK and the ‘distance anxiety’ with many buyers whereas other sources of power - Hydrogen - can be just as easily sourced and cause less pressure on already saturated systems. However, it seems the want for this is not as strong as EV’s, so it may be a case of going with EV’s until a better or more viable solution becomes available - which is a costly but not altogether surprising solution based on many governmental decisions amongst the COP26 group.

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