



Highly Commended

Science Writing Year 9-10

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Developing Electric and Hybrid vehicles to reduce air pollution from transportation.

Air pollution has been a growing concern for many people globally and a main contributor to climate change. Poisonous and harmful substances, such as chemicals, produced by human activity or naturally, which alter the earth's atmosphere and air, are the cause of air pollution (who.int, 2023). Vehicle emissions, the burning of fossil fuels like coal and oil, and gases from manufacturing and power plants are some of the main causes of air pollution (niehs.nih.gov, 2023). The harmful chemicals released into the air by these sources include carbon monoxide, lead, nitrogen oxides, ozone, particulate matter, and sulphur dioxide (cdc.gov, 2023). These toxic chemicals pose a major concern for human health as they increase the risk of lung cancer, heart disease, and respiratory disease. There are 1 in 3 deaths from lung cancer, strokes or respiratory diseases globally are caused by air pollution (clientearth.org, 2023).

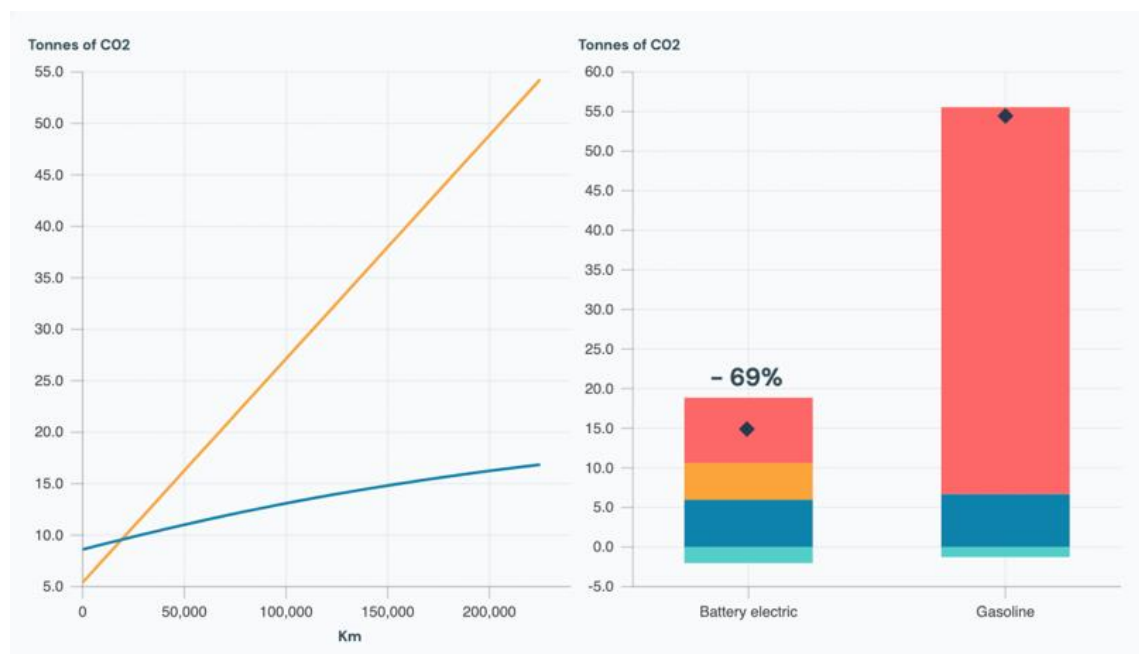
There are ways to minimise the chemicals released into the air, which is a global problem. The development of electric and hybrid cars in place of gasoline vehicles will contribute significantly to reducing air pollution, as vehicle emissions are one of the main causes. Hybrid electric vehicles (HEVs) are powered by a combination of a combustion engine and electric motors that draw energy from batteries (energy.gov, 2023). As they rely on regenerative braking and internal combustion engines, HEVs don't require a plug to charge (afdc.energy.gov, 2023). The kinetic energy that is converted into potential or stored energy when the brake is applied by the regenerative braking system causes the vehicle to slow down, increasing fuel efficiency. As fuel is ignited and burned inside the engine, the internal combustion engine also contributes to the vehicle. The power source for electric vehicles (EVs) is an electric motor that is fed by a battery that must be charged externally (energy.gov, 2023). An electric vehicle has two ways of propulsion but uses different fuels. The reduction of substances released into the air that have an adverse impact on the climate and human health will be made possible by this solution.

The use of electric vehicles will reduce the amount of fossil fuels in our air, which contribute to climate change and human health issues. The first advantage of electric cars is that they will reduce pollution, which is good for the environment. As shown in the graph below, electric

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vehicles produce 69% less carbon dioxide overall than gasoline-powered vehicles (transportenvironment.org, 2023). A typical gasoline car emits around 241g of carbon dioxide per mile, while a typical electric car only emits 75g (transportenvironment.org, 2023). As you can see, an electric vehicle will always produce less CO₂ than a regular gasoline vehicle, which produces three times as much and has an adverse effect on our climate. Another thing to keep in mind is that by lowering these emissions, we are also lowering the risk of stroke, lung cancer, respiratory disease, and many other health issues in people. If these emissions are being released, these factors are very concerning, but with this solution we can alleviate all the chances of this.

Figure 1:



Tonnes of CO₂ emitted in a lifetime through Electric and Gasoline Cars (transportenvironment.org)

Although there are many advantages, there are a number of drawbacks to using EVs in the long run. The batteries that power electric vehicles are one important problem that will result from their use. Lithium-ion batteries, which are used in electric vehicles, contain dangerous elements like lithium, nickel, and cobalt that are extracted from the earth using fossil fuels (climate.mit.edu). These batteries typically have a lifespan of five years or 2,000–3,000 charging cycles (uetechologies.com, 2023). Although the battery can lose some of its capacity every time it is recharged and used, it is estimated that only 2.3% of the battery's capacity is lost annually (blog.evbox.com). Therefore, when a battery reaches the end of its

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useful life, many of them are not properly disposed of or recycled, and the hazardous chemicals inside are dumped unethically. Jessika Richter, a researcher in environmental policy at Lund University, said, "There is a lot of [battery] capacity left at the end of first use in electric vehicles." (XiaoZhi Lim, 20th Aug, 2021). These batteries may not be suitable to run another car but could be used for other purposes, like solar or wind farms. For instance, the Enel Group and Nissan have partnered to create an energy storage facility that uses old Nissan Leaf car batteries. (XiaoZhi Lim, 20th Aug, 2021).

Many businesses and professionals are working hard to discover ways to recycle or dispose of these batteries. When lithium-ion batteries have used up all of their life span, one method that might work is to extract the materials inside and reintroduce them into the battery supply chain. Redwood Materials, a business, has raised \$700 million to expand its operations and use the aforementioned method to get rid of lithium-ion batteries (XiaoZhi Lim, 20th Aug, 2021). Although lithium-ion battery waste will increase by 20% annually and surpass 136,000 tonnes by 2036, this is a global issue (csiro.au). As you use electricity to charge EVs, you can now produce greenhouse gases, which is unsustainable for the environment. However, there is a solution that can be used to fix this. This is done by purchasing Greenpower, a renewable energy product, so that when you charge your electric vehicle from power grids, the energy is also renewable. Another important consideration is price, as electric and hybrid cars are significantly more expensive than the typical petrol-powered car. Additionally, batteries are comparable, so every five years you would have to buy one for half the price of a gasoline vehicle.

Electric and hybrid vehicles are the best way to reduce emissions that are released into the atmosphere, despite the numerous issues that have been brought up by the solution. Although electric and hybrid vehicles have both benefits and drawbacks, overall, they emit fewer emissions than gasoline-powered vehicles. As you can see from the information above, companies and experts from all over the world are working hard to find solutions to the issues caused by EVs. Although nothing will be perfect, electric and hybrid vehicles are the first and most important step towards lowering air pollution. Electric and hybrid vehicles have undergone extensive research over the years, and this is just the beginning.

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