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The Effects on The Economy and Environment Caused By Electric Cars Compared to The Conventional Ones

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Abstract

From year to year, the environment situation is worsening at an alarming rate. Air pollution has reached record levels, which is why ozone layer have come to be seriously affected. All these aspects lead to the warming of Earth and had a negative impact on people's health. Therefore, humanity has begun to focus more and more on remedying these adverse effects through various methods, which are more or less effective. In the case of CO₂ emissions that are higher than ever, the solution is a very complex one and difficult to achieve. For this reason, various alternatives have appeared: electric cars, hybrid cars, as well as those with hydrogen, compressed natural gas and bioethanol. Since electric cars are the first choice as an alternative and they have shown a great potential, the purpose of this paper is to present whether or not this alternative is really a "greener" choice or not. To achieve this purpose, a literature review and a data analysis provided by Eurostat, U.S. Department of Energy and the Organization of the Petroleum Exporting Countries were performed. The results of this study highlight that the sustainability of the electric cars is influenced by the geographical area where they are used.

Keywords: Economy, Environment, Electric Cars, Sustainability

Introduction

Modern society depends on the movement of goods and people, but our current transport system has negative effects on human health and the environment. Nowadays, pollution is one of the most important and topical subjects. A very large part of it comes from internal combustion cars that pollute more or less, depending on the type and dimensions of the engine. Thus, various alternatives have appeared over time, but none was as well seen as that of electric motors. This type of engine has shown a high potential from the very beginning and attracted a lot of people to its side. With all this "hype" created by companies like Tesla or Toyota, people no longer pay enough attention to details such as economic effects and even the very basic idea of reducing pollution (Prud'homme & Koning, 2012). The comparative analysis between electric cars and internal combustion cars presented in this paper has been carried out based on the public data and statistics presented by various organizations. The next sections describe the methods used for collecting and processing data, as well as the main findings of the research.

Methods

The comparison was chosen as the main method of work because it allows us to form a basis, respectively a reference point that helps us evolve and make a decision that subsequently leads to an improvement. At the same time, comparison helps to deepen knowledge, as well as identify and understand differences.

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Global Impact on Jobs

The automotive industry is a pillar of the global economy, respectively the main factor of the growth and stability of macroeconomics. This industry has grown and continues to grow, registering a growth of 30% from 1995 to 2005, according to International Organization of Motor Vehicle Manufacturers. Due to the wide scale at which it operates, the automotive industry creates a lot of jobs (for example, to create 60 million cars, it takes about 9 million employees to work directly in the construction of the car). This number represents more than 5% of the global number of manufacturers. At the same time, it is estimated that each job in the automotive industry supports at least 5 more jobs in the community, resulting in a total of more than 50 million jobs. Thus, in order to produce a car, other industries that produce iron, glass, plastic, textiles, computers or rubber are needed (Del Pero et al., 2018). On the other hand, the production of electric vehicles, including their batteries, generally require less manpower than those that run on gasoline / diesel.

For this reason, the World Economic Forum highlights that Germany can suffer a cut of 600,000 jobs during the next 10 years, if the combustion engines will be gradually replaced with electric ones (Nanaki et al., 2013). In addition to this threat that electric cars pose to workers, their industry is still facing a series of harsh accusations from human rights. The number of electric cars is growing very quickly. In 2019, more than 3 million cars have been bought and the sales are increasing by almost 75% every year. However, doubts about the ethics of buying an electric car have also gradually increased. For instance, Amnesty International, a human rights organization, accuses the industry of abusing children who are put to work in extracting ores such as cobalt that is used in the batteries production. According to Amnesty, the production of batteries for electric car industry uses 60% of the total 125,000 tons of cobalt extracted annually on the globe (Lave, 1995).

Global fuel and electricity prices

As electricity and fossil fuel prices differ enormously across continents, countries or even regions, their impact on any car owner's final fuel spending is different. Therefore, in order to identify if it is better to have an electric car or an internal combustion one, local prices of both kWh and one liter of gasoline should be taken into account.

Electricity price

The most important components of the electricity price are represented by the costs of developing, maintaining, and operating a power plant, and the profit margin set by the energy supplier (U.S. Department of Energy, 2016). The research conducted in this field showed that the price paid by the plant for the fuels from which it produces the energy is the key factor that influences its production costs and indirectly the price of electricity (Lowell et al, 2017).

Another important factor that influences the electricity price is the weather conditions. For instance, a rainy season can be very beneficial for a hydropower plant, while a dry and hot season can negatively affect the production of electricity. The outside temperature also impacts the consumption level. During the summer, the demand for electricity tends to be higher due to the use of air conditioning devices. For this reason, in a free and competitive economy, an increase in demand will lead to a rise of electricity price. However, there are many countries and regions where the government keeps the electricity price under control through legislative regulations (U.S. Department of Energy, 2016).

The price of a kWh is influenced by the type of customer as well. The lowest price per kWh is paid by the industrial organizations because they use large amounts of electricity. In this case, the delivering can be done at higher voltages, which is less expensive and more efficient. The commercial consumers tend to pay a higher price compared to the first type of customer mentioned above, while the residential consumer usually pay the highest price for electricity (U.S. Department of Energy, 2016).

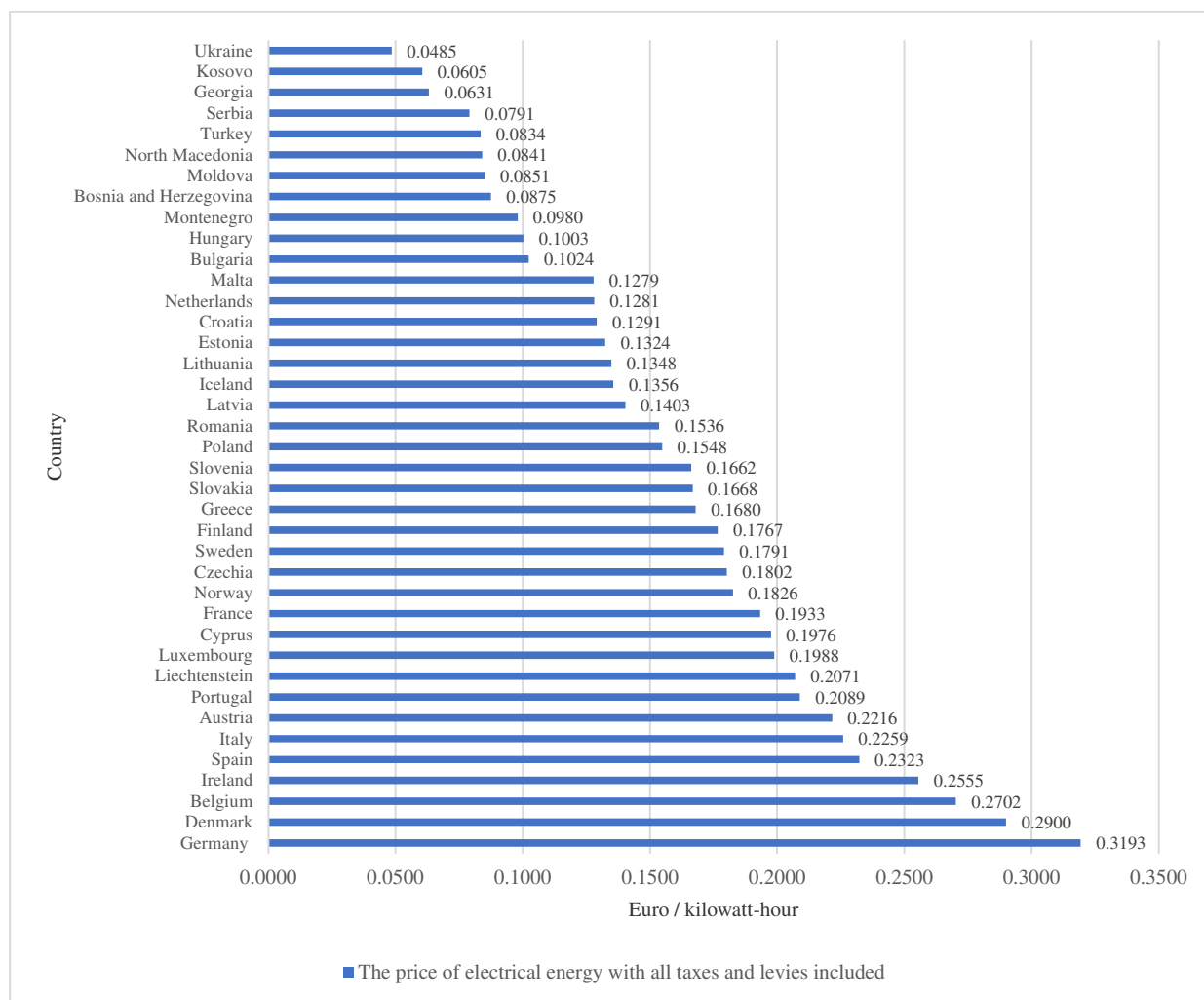


Fig 1. The price of electrical energy with all taxes and levies included in 2021 (first semester)

Source of data: Eurostat (2022)

Finally, the location of the final consumer is another price determinant (Palinski, 2017). The availability of fuels and power plants, local costs and the regulation of local prices have a great impact on the electricity price. By analyzing the data presented in Figure 1, it can be noted that kWh is relatively expensive in Germany, Denmark and Belgium, the price in these countries moving between 31.93 and 27.02 eurocents. On the other hand, non-UE countries like Ukraine, Georgia or Serbia, enjoy more affordable electricity. In these countries, the electricity price ranges from 4.85 to 7.91 eurocents, which represents less than 70% of the highest prices in Europe.

Prices for gasoline and diesel

The gasoline used for personal vehicles differs depending on the octane level, that measure the quality of the fuel. Ordinary gasoline is the cheapest, followed by medium gasoline and the premium one.

If we analyze the basic composition of the oil price, five main components should be taken into account. The first one is the cost of crude oil, which is considered to have the greatest influence on the final price of gasoline and diesel. The Earth's reserves of crude oil, as well as its supply and price are managed by the Organization of the Petroleum Exporting Countries made up of 13 countries exporting crude oil. The next contributors to gasoline's retail prices are then government-added tax, refining costs, marketing and distribution and profits (Bento et al., 2017).

Similar with the case of electricity, the place of final consumption is another factor that influences the price of gasoline. Usually, the petrol price is higher in the rich countries, with a high average income per capita, than in the poor countries. An exception to this rule is the US (1.112 euro per liter), where the gasoline has one of the cheapest retail prices across the world, even though the country's economy is very developed. Other examples of countries where the ratio between gasoline price and average income is affordable are Canada (1.368 euro per liter) and Australia (1.427 euro per liter) (Palinski, 2017). In Europe, countries such as the Netherlands, Norway, Denmark, Finland and Italy, have almost a double retail price of gasoline, the price range moving between 2.34 and 2.09 euro per liter. At the other extreme, the cheapest final retail prices of gasoline from European Union can be found in countries such as Hungary, Bulgaria and Poland, where people paid between 1.28 and 1.44 euro for a liter in March 2022. The retail price of diesel fuel tends to be influenced by similar factors to those described in the case of gasoline. For this reason, the price of the two types of fuels is usually close in a country (Palinski, 2017).

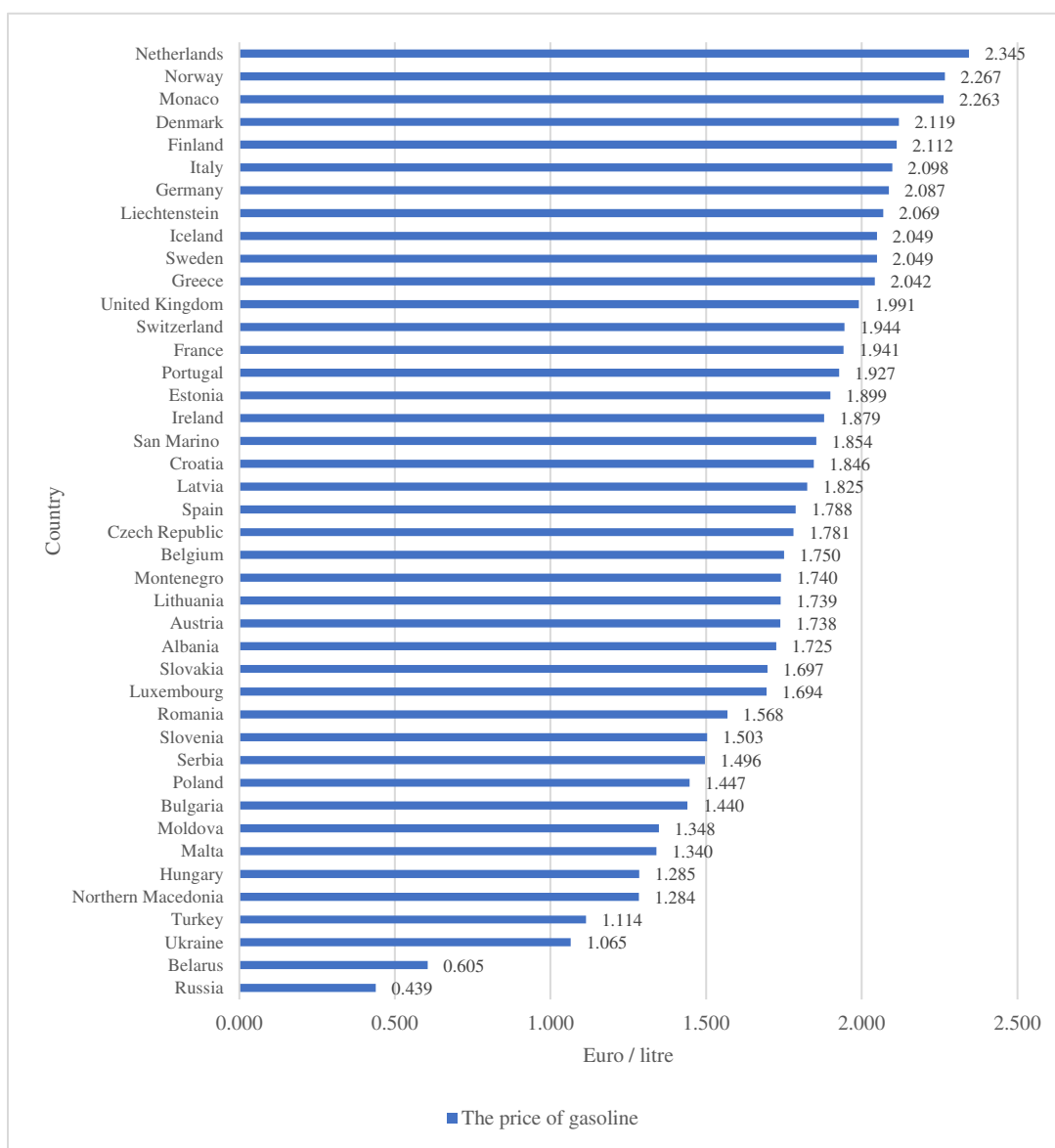


Fig 2. Gasoline prices in March 2022

Source of data: GlobalPetrolPrices.com (2022)

Negative effects on the environment - electric cars

Production of the cars

The studies in this field highlighted that the manufacture of an electric vehicle tends to generate more CO₂ than the production of a combustion engine vehicle (Granovskii et al., 2006), especially because of its battery. Producing an average petrol car generates 5.6 tons emissions of CO₂, while for an average electric car the figure is 8.8 tons. In the case of the electric cars, half of the emissions are due to the battery production (Helmert & Weiss, 2017).

During the entire life cycle of the electric car, it would produce 80% of the emissions of a vehicle that consumes gasoline. In addition, “the production of electric cars uses rare metals such as neodymium, dysprosium and terbium, not to mention lithium, which all have environmental consequences” (Zhao et al., 2021). Mining of rare metals usually has harmful side effects, leaving behind toxic waste that could pollute the environment (Ortar & Ryghaug, 2019). For these reasons, some car producers are seeking to find alternative solutions for replacing or reducing the use of such metals in batteries (Kavanagh, et al, 2018). A good example is Toyota which tried to reduce the use of neodymium in its batteries with the help of a magnet (Zhao et al., 2021). However, the materials used in the batteries of electric cars are still representing a great concern and future studies are needed for solving the negative effects they generate.

The electricity production

Analyzing the sustainability of an electric car should also take into account how was produced the electricity on which it operates. If the car is supplied with energy that comes from a solar panel, its negative impact on the environment is much lower compared with the case in which the energy was produced from coal. Indirectly, an electric car supplied with electricity that was produced from coal will generate CO₂ emissions. What should be noted is that there is no technology with 100% free emissions. Even the manufacture of solar panels generates emissions. However, some technologies pollute more than others, and from this point of view electric cars can be considered much more sustainable than those that use gasoline. To minimize the negative impact on the environment produced by cars, a recommended solution is to purchase an electric vehicle together with a solar panel system (Varga & Mariasiu, 2018). In this way, the savings will be maximized, while the carbon footprint will be reduced. Also, by charging the car in a slow mode rather than in a fast one will create the possibility to use the wind power for generating energy, that would be much more efficient (Sobol & Dyjakon, 2020). Slow charging off-peak hours gives the most efficient use of sustainable energy (Dobrea et al., 2018).

Negative effects on the environment – internal combustion machines

Burning fossil fuels, such as gasoline and diesel, releases greenhouse gases that accumulate in the Earth's atmosphere, leading to climate warming and extreme weather events that can move wild populations, destroy habitats, and contribute to rising ocean levels (McConnell et al., 1990). Air pollution can also negatively influence the quality of soil and water in the natural environment. Aside from what comes out of the exhaust pipe of a car, the environmental pollution during the extraction of these fossil fuels is also high. Not to mention, the manufacture of vehicles from the production of materials such as plastic, paint and rubber that can contribute to pollution before the cars even reach the road. Even gasoline vapors that escape into the air when pumping into tanks play a role in air pollution. Also, the disposal of old machines (usually compacted in a landfill after they have been disassembled for parts) has an impact on the environment, since different parts of the machine take longer or less to decompose. Studies have also suggested that asphalt could be a long-lasting source of pollution.

Conclusion

The general purpose of this article was to identify and understand both the economic and ecological aspects of this pollution crisis caused by vehicles in use and without which we could not live as we do today. In the first phase, the theoretical part that assists in understanding an overall picture was put into practice, more precisely the importance of this industry from an economic point of view on a world scale and at the same time the speed with which it evolved and continues to evolve. In the second part we used both theoretical aspects and a data analysis, conducted with the help of information provided by the Eurostat, U.S. Department of Energy, and the Organization of the Petroleum Exporting Countries, through which we displayed economic differences between the two industries regarding the price of fuels. According to the figures presented above, it can be inferred that the result will always depend on where the comparison is made, the price being in a continuous fluctuation. The third part aimed to present objectively the level of pollution produced by both conventional and electric vehicles, thus outlining the final

idea: even if electric cars are the best alternative at the moment, their production also poses economic problems, such as the jobs that will be diminishing, and last but not least, the fact that they also have a high degree of pollution despite appearances.

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