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Yeşil-Elektrikli Araçların "Çevrecilik" Bakımından , Sosyal Antropolojik Bakış Açısı İle Değerlendirilmesi

Evaluation of Green-Electric Vehicles in Terms of "Environmentalism" with a Social Anthropological Perspective

Onur HAYIRLI [1]

Öz

Yeni çözümler her zaman yeni sorunları beraberinde getirir. Yeşil araçların yükselişi, ulaşımın çevresel etkisini azaltmaya yönelik önemli bir adım olarak müjdelendi. Elektrikli araçlar, hibritler ve diğer çevre dostu alternatifler, emisyon azaltımı ve daha yeşil bir gelecek vaatleriyle son yıllarda popülerlik kazandı. Ancak soru hala ortada: Yeşil araçlar gerçekten çevre dostu mu? Bu kapsamlı akademik makale, üretim, enerji kaynakları, araçların gerçek pratik kullanımı ve genel karbon ayak izi gibi faktörleri göz önünde bulundurarak yeşil araçların çevresel etkilerini incelemektedir. Yeşil araçların tüm yaşam döngüsünü analiz ederek çevresel faydaları ve zorlukları konusunda dengeli bir değerlendirme sağlanması amaçlanmaktadır. Konuya sosyal antropolojinin bakış açısı ile yaklaşmayı amaçlar.

Anahtar Kelimeler: Çevre, Elektrikli Araçlar, Toplumsal Davranış, Ulaşım

ABSTRACT

New solutions always bring new problems with them. The rise of green vehicles has been heralded as a significant step towards reducing the environmental impact of transportation. Electric vehicles, hybrids, and other eco-friendly alternatives have gained popularity in recent years, with reduced emissions and the commitment of the greener future. However, the question still remains: Are green vehicles truly environmentally friendly? In this comprehensive research article, we have delved into the environmental impact of green by considering some factors such as manufacturing, energy sources, actual practical use of vehicles, and their overall carbon footprint. By analyzing the lifecycle of green vehicles, we have aimed to provide the balanced assessment of both their environmental benefits and challenges.

Keywords: Electric Vehicles, Transportation, Public Behavior, Environment

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1. INTRODUCTION:

Green vehicles, also known as environmentally friendly vehicles or eco-cars, have garnered attention as a sustainable solution to combat the environmental problems associated with conventional gasoline and diesel-powered vehicles. These green vehicles include electric vehicles (EVs), hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), and hydrogen fuel cell vehicles. The environmental benefits attributed to green vehicles encompass reduced greenhouse gas emissions, decreased air pollution, and a lower reliance on fossil fuels. However, this article seeks to critically evaluate whether these claims stand up to scrutiny when examining the complete lifecycle of green vehicles.

The reality of modern man is that he must be mobile, or he has to carry some items from one place to another. It is a must. It may be necessary to minimize this, to live minimalistic lives just like the Japanese culture, to use fewer items throughout our lives, to not allow luxury consumption in any way, and perhaps even to restrict the uncontrolled growth of the population. In terms of transportation, it would be useful to choose lighter and minimized ones.

Countries like Germany have emerged as a global leader in the transition to green technologies, exemplifying a remarkable shift towards sustainability and environmental consciousness. The country's commitment to renewable energy sources, particularly wind and solar power, has led to a substantial reduction in greenhouse gas emissions and a significant decrease in the reliance on fossil fuels. Germany's Energiewende (we can call it greenization) policy, launched in the early 2000s, has played a pivotal role in this transformation, emphasizing the development of clean energy infrastructure and the phasing out of nuclear power. Additionally, Germany's robust electric vehicle (EV) industry, with notable companies like Volkswagen and BMW pioneering innovative EV models, demonstrates the nation's dedication to sustainable transportation solutions. This transition to green technologies in Germany sets a compelling example for the rest of the world, showcasing the economic and environmental benefits of investing in a more sustainable future.

The biggest criticism of the Germans here is that they continue the tradition they have brought since World War II, regarding their vehicles being large and cumbersome. The Germans, who produced vehicles of the same size in the same lines that used to produce tanks, should turn to produce light vehicles like the French, Russians, and Chinese. They should avoid indulging in or importing luxury and prestige and set a good example for other countries.

The issue of electric cars is a multifaceted problem.

The study focusing exclusively on SUVs reveals that the introduction of electric SUVs may not effectively reduce car emissions in Europe. It suggests that exploring alternatives such as decreased dependence on technological solutions, smaller vehicle sizes, and lower levels of motorization could be valuable in achieving significant climate objectives. Additionally, more investigation is required into how automotive companies manage battery distribution (Gómez Vilchez et al., 2023). To put it more clearly, although batteries are not mentioned, it appears that e-SUVs do not contribute positively to climate change.

In order to break people's habits of conservatism and reduce expensive costs, governments should encourage the sale of e-vehicles. According to research conducted in Greece (Mpoi et al., 2023) “provision of financial incentives by the government significantly increase the willingness to purchase an EV. Travel and demographic characteristics, environmental awareness, characteristics of EVs (i.e., charging time), and infrastructure (charging stations network) were also found to affect the intention to purchase an EV.” So trying to change the behavior of people is another struggle. Another research (Paradies et al., 2023)in Netherland said that; “current barriers for EV adoption: higher purchase price and lower driving range, will become less important over time. In 2030 routine purchasing behavior and social factors are the main barriers for widespread EV adoption.” The two most important factors why people choose electric vehicles are high vehicle prices and low driving range.

The energy required for manufacturing EV batteries and electric motors is more 1.3 and 1.2 times that for petrol and diesel cars. The EV run on coal-fired electricity is the biggest emitter of emissions and air pollutants due to

abundant nonrenewable energy consumption, followed by internal combustion engine vehicles and EVs charged by oil-fired power. (Safarian, 2023)In other words, producing electric vehicles, producing batteries, recycling them, and producing the electricity required for electric vehicles are harmful to the environment. I hope, for nature's sake, that further studies will be conducted that reach the opposite conclusion.

A study (Blanco-Muruzábal et al., n.d.)conducted in Spain shows that society is not yet ready for parking spaces. Charging problems create overload in the network. Current underground parking spaces also pose a hazardous fire problem. In the first stage, even underground parking of vehicles may be prohibited.

One solution to the charging problem is replacing it with modular removable batteries. Some research(Athanasopoulou et al., 2023) focuses on "the vehicle's batteries are replaced with a fully charged one (available at the station), while new modular batteries could be made on the spot."

When mobile phones first appeared, their batteries could be removable, so with your old Nokia phone, you can have a spare battery with you and can replace it in seconds on the way. But then non-removable batteries came also with "big brother watching you" ideas. Is there a possibility to the way of controlling e-cars? USA police already using a kind of electric shutter on cars. So the idea that kind of a government can follow and control your mobility or limit where you go does not look very realistic at first stage because they can already do that in today's cars and electronic infrastructure if the government wants to do so.

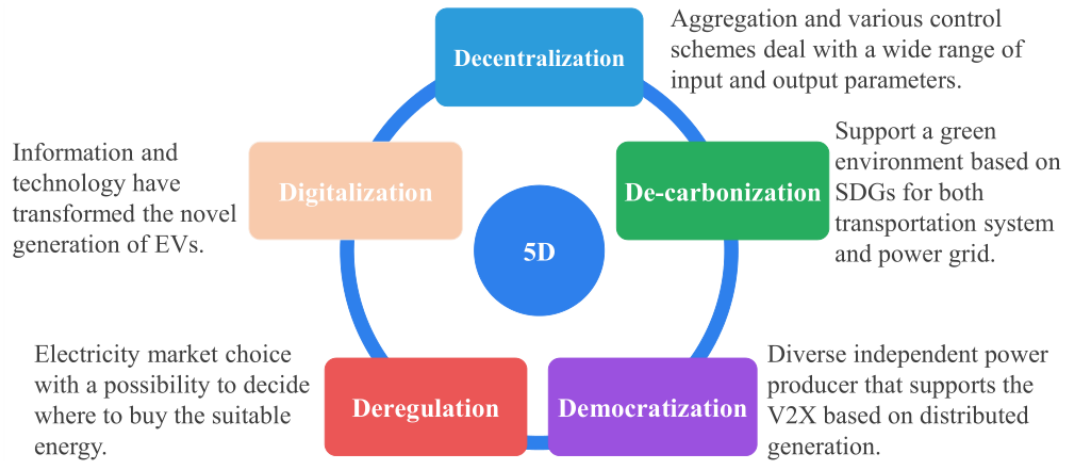

Figure: The 5d Vision of Electric Vehicles (Ismail et al., 2023)

Research in Indonesia claiming that EV cars have very little impact or extra costs on the environment. "EV production will have extra external costs of emissions, around Rp. 2.23 trillion, or an increase of about 0.6%. Based on these findings, it is concluded that electric vehicle production increases productivity, gross value-added, and job creation with a relatively small impact on the environment. " (Pirmana et al., 2023) But the opposite idea came from research conducted in Romania, "In terms of life cycle emissions, the tested full-electric cars based on renewables show a noticeable reduction in greenhouse gases and in other relevant pollutants: 37% and 62%, respectively, lower than that of conventional cars."(Machedon-Pisu & Borza, 2023)

Another one approaching this issue from the economical perspective which is a good prediction; "On the extensive margin, purchase incentives should ramp down as learning-by-doing and network externalities (to the extent that they exist)diminish; on the intensive margin, gasoline should become relatively more expensive over time than electricity (per mile traveled) to reflect cleaner marginal emissions from electricity generation."(Rapson & Muehlegger, 2021) Even if it's a free market, governments intervening in the EV market and gas prices can change the value of the energy as a electric or gasoline. So, the market can be affected directly from those economic games.

2. Lifecycle Assessment and Manufacturing Process

A comprehensive assessment of the environmental impact of green vehicles must consider their entire lifecycle. This involves three main phases: Manufacturing, Operation, and end-life process.

The manufacturing phase includes the extraction of raw materials, processing, and assembly. Green vehicles, particularly EVs, rely heavily on lithium-ion batteries, which require the extraction of rare minerals like lithium, cobalt, and nickel. These mining operations can have severe ecological consequences and raise ethical concerns related to human rights and labor practices. Additionally, the energy-intensive manufacturing process for batteries and other components can result in substantial greenhouse gas emissions.

Africa is emerging as a promising hub for car battery production, driven by the global shift towards electric vehicles and the continent's abundant reserves of key resources, such as lithium, cobalt, and nickel. Several African countries, including South Africa and Morocco, are making significant investments in battery manufacturing facilities, with an eye on not only meeting domestic demand but also establishing themselves as major players in the global electric vehicle market. This development has the potential to create jobs, boost local economies, and reduce Africa's reliance on battery imports, marking a significant step towards sustainable and environmentally friendly transportation solutions on the continent.

Although it is not directly related to this subject, it is useful to touch on an important issue regarding African countries. It would not be fair to turn a blind eye to this issue while trying to improve the quality of the environment and human life.

Child labor in battery production is a concerning issue in some parts of Africa, where the demand for essential minerals like cobalt, which is a key component in lithium-ion batteries, has led to exploitative labor practices. Children are often found working in hazardous and grueling conditions in mines, where they are exposed to health risks and denied access to education. This practice not only infringes on their fundamental rights but also perpetuates a cycle of poverty, limiting their future opportunities. Efforts are being made by international organizations, governments, and corporations to address this issue and ensure that battery production in Africa is ethical and sustainable, with a focus on eliminating child labor from the supply chain and improving the welfare of the affected communities.

To summarize the issue of batteries, the developed West cannot turn a blind eye to the injustice and human rights violations in battery production. If the history of a piece of meat can be determined by the barcode on it, then how a large battery is produced can be followed. Instead of remaining silent, developed countries should monitor working conditions with an aggressive policy and be responsible.

During the operational phase, green vehicles are praised for producing fewer tailpipe emissions and reduced energy consumption compared to their internal combustion engine counterparts. EVs, in particular, produce no tailpipe emissions, relying on electricity as their primary source of power. However, the environmental benefits of this phase depend on the source of electricity, which is often derived from a mix of fossil fuels, renewables, and nuclear power. The environmental impact of this phase varies depending on the energy grid's composition.

The end-of-life phase entails vehicle disposal, recycling, and material recovery. Green vehicles' long-term sustainability depends on their ability to minimize waste and maximize recycling and reuse. While many components in green vehicles are recyclable, some, like lithium-ion batteries, pose recycling challenges and concerns about hazardous waste management.

3. Environmental Benefits and Challenges

3.1. Greenhouse Gas Emissions

According to the report “The Long-Term Strategy of The United States: Pathways to Net-Zero Greenhouse Gas Emissions” by 2050, USA government planning steps for emissions till 2050.

To achieve this objective, the United States aims for 50% of new light-duty vehicle sales in 2030 to be zero-emission models, plans to produce 3 billion gallons of sustainable aviation fuel by the same year, and seeks to enhance the deployment and affordability of all transportation modes. This will involve lowering vehicle prices, implementing fuel economy and emissions standards for light, medium, and heavy vehicles, offering incentives for zero-emission vehicles and clean fuels, investing in new charging infrastructure for multi-unit residences, public charging, and long-distance travel, scaling up biorefineries, supporting innovative efforts to decrease hydrogen production costs, and enhancing infrastructure that facilitates all types of clean transportation, including transit, rail, biking, micro-mobility, and pedestrian pathways. This information with more detail is stated in the following source, (November 2021, USA) more detailed information can be found there.

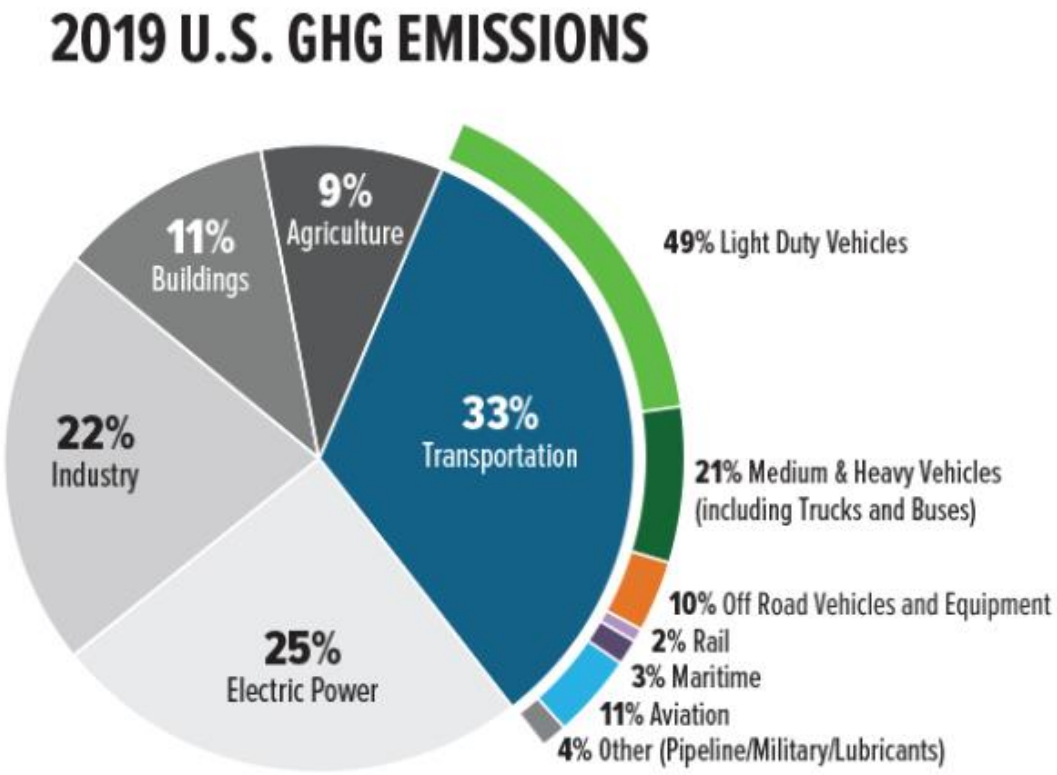

Table 1: A Graph Showing the Number of Vehicles in the USA, Taken from the U.S. Environmental Protection Agency Website, 10/10/2023, https://www.epa.gov/greenvehicles/why-we-need-decarbonize-transportation#note

Green vehicles are generally lauded for their lower greenhouse gas emissions during operation. However, as mentioned earlier, the extent of this reduction depends on the energy source. In regions with a high proportion of fossil fuel-based electricity generation, the emissions advantage of green vehicles is reduced compared to areas with a cleaner energy mix. Moreover, the manufacturing phase can offset operational benefits if it results in a significant carbon footprint.

3.2. Air Quality

Green vehicles contribute to improved air quality in urban areas due to their lower tailpipe emissions. This positive impact is most pronounced in areas with high levels of vehicular traffic and poor air quality. However, it should be noted that tire and brake wear, as well as the production of electricity for EVs, still generate particulate matter and emissions.

According to some governments, “There is limited evidence to suggest that diesel may be nephrotoxic” (R P Chilcott, 2007) Even governments sources say maybe yes, they kill, many articles prove that, “ (Griffin, 2008). (Leong, 2017) İts like buying a cellphone or wireless headset or microwave air fryers, they have SAR value which chaos health problems. So, it is not written on the box. Remember the times doctors in USA suggested people smoke cigarettes? Or nuclear tests without thinking about the consequences on human health.

3.3. Energy Sources and Population Grown

The environmental impact of green vehicles is heavily dependent on the source of electricity. In regions where renewable energy sources dominate, the benefits of green vehicles are more substantial. However, in areas heavily reliant on coal and other fossil fuels, the advantages are diminished, and in some cases, the carbon footprint may be greater than that of conventional vehicles.

Rapid population growth can also have several detrimental effects on world resources and humanity, leading to a multitude of challenges and concerns:

1. Resource Depletion: The exponential increase in the global population places immense strain on finite resources such as freshwater, arable land, and fossil fuels. Overexploitation of these resources can lead to scarcity and negatively impact food and water security, as well as energy availability.

2. Environmental Degradation: A growing population often results in increased deforestation, habitat destruction, and pollution. These activities contribute to habitat loss and biodiversity decline, leading to ecological imbalances and the endangerment of many species.

3. Food Insecurity: Rapid population growth can outpace the growth of agricultural production, making it difficult to feed everyone. This can result in food shortages, malnutrition, and increased competition for available food resources, which can exacerbate global hunger issues.

4. Water Scarcity: More people require more water for consumption, agriculture, and industry. The increased demand for water resources can lead to shortages, especially in regions already experiencing water stress, which can lead to conflicts over water access.

5. Urbanization Challenges: As populations surge, there is an accelerated migration to urban areas, leading to overcrowding, inadequate housing, and strain on infrastructure and public services. This can give rise to issues like inadequate sanitation, disease outbreaks, and increased poverty in urban slums.

6. Energy Demands: More people lead to higher energy demands. In cases where fossil fuels are a primary energy source, this can contribute to increased greenhouse gas emissions and exacerbate climate change.

7. Strain on Healthcare: Rapid population growth can overwhelm healthcare systems, making it difficult to provide adequate healthcare services, leading to issues related to maternal and child health, infectious diseases, and healthcare access disparities.

8. Economic Challenges: A rapidly growing population can pose economic challenges, as it may be difficult to create enough jobs to accommodate the workforce, leading to unemployment and underemployment, particularly among the youth.

9. Social and Political Instability: Rapid population growth can exacerbate social and political tensions, especially in regions with limited resources. Competition for these resources can lead to conflicts and instability, contributing to refugee crises and mass migrations.

So, rapid population growth has a very important role when planning the resources, world resources, and humanity by depleting natural resources, causing environmental degradation, and leading to food and water insecurity, among other challenges. Addressing these issues requires a comprehensive approach that includes

sustainable resource management, family planning, and policies aimed at achieving a balance between population growth and available resources.

3.4. City Charge Problems.

Addressing the charging problems of electric cars in cities requires a comprehensive and collaborative effort from governments, city planners, private entities, and the public. By strategically deploying charging infrastructure, incentivizing private installations, and leveraging innovative technologies, urban areas can overcome the challenges associated with the growing demand for electric vehicles, paving the way for a more sustainable and electric future

Urban spaces often face limitations in terms of available land for establishing charging stations. The lack of dedicated spaces for EV charging stations makes it challenging to cater to the growing number of electric vehicles in cities. This scarcity can lead to long waiting times and increased competition among EV users for charging spots. However, integrating EV charging infrastructure with existing public transport networks requires careful planning and coordination. The lack of seamless integration may deter users from making the switch to electric public transportation options. By strategically deploying charging infrastructure, incentivizing private installations, and leveraging innovative technologies, urban areas can overcome the challenges associated with the growing demand for electric vehicles, paving the way for a more sustainable and electric future. For example, if everyone uses electric cars in the city of İstanbul right now, the energy infrastructure collapses immediately.

But in some states of the United States, where this technology is already more widespread, waiting times at charging stations are extremely high. It is not vehicle charging time, it's about the time you have to wait to charge your vehicle. It should also be noted that there is a loss of workforce and energy while waiting.

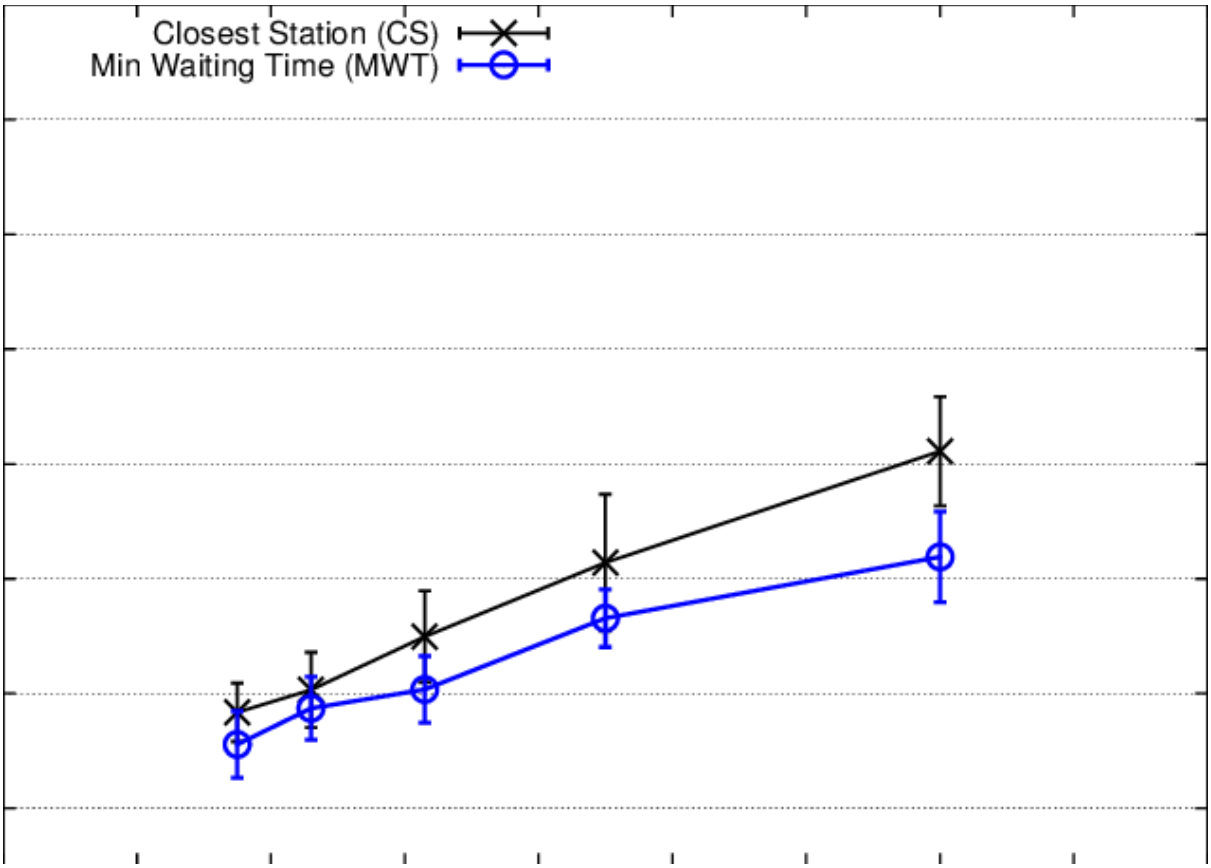

Table 2: Average EV Waiting Time as a Function of the Charging Request İnterarrival Rate in a 40 km x 40 km Area. (Gharbaoui, 2012)

One of the countries taking the fastest policy steps in electric vehicles is Norway. All vehicles must be electric by 2025. One of the studies conducted on this subject shows that the biggest problem is charging problems.

In Norway, the aim is for all new personal vehicles to be zero-emission by 2025. This primarily refers to electric vehicles, as the proportion of hydrogen-powered cars is minimal. As of August 2022, approximately 70% of newly registered cars are electric. To achieve this policy objective and support the increasing number of electric vehicles, robust charging infrastructure is essential. A key factor influencing the decision to charge is the ability to reach a destination without needing to stop for a charge. Therefore, to encourage the use of EVs on longer journeys that surpass the vehicle's range, there must be sufficiently fast charging options available along the way.

4. Battery Producing Problems

The production of car batteries, particularly those for electric vehicles (EVs), faces several significant challenges that impact both the environment and supply chain stability. One major issue is the extraction and processing of raw materials, such as lithium, cobalt, and nickel, which are crucial for battery performance but are often mined under environmentally harmful conditions and in regions with questionable labor practices. Additionally, the refining process for these materials is energy-intensive, contributing to greenhouse gas emissions. Supply chain disruptions also pose a problem, as geopolitical tensions and trade restrictions can lead to shortages and increased costs. Furthermore, recycling rates for used batteries remain relatively low, exacerbating concerns about resource depletion and waste management. Addressing these problems requires advancements in sustainable mining practices, improved recycling technologies, and innovations in battery chemistry to reduce reliance on scarce materials.

5.1. Africa And Battery Production

Africa is the biggest source of minerals; main materials for battery producing like cobalt, lithium, manganese, nickel and graphite are came from the Democratic Republic of Congo, Zambia, South Africa, Madagascar, Mozambique, Tanzania or Gabon. "Lithium-ion batteries dominate the EV market and represent about 49% of the global rechargeable battery market. The DRC alone is estimated to have several million tons of lithium reserves. More is to come: the current confirmed mineral resources in Africa could be a tip of the iceberg." (ADBG, 2023)

China, Europe and the United States — which are collectively responsible for 60% of all global car sales. (Jaeger, 2023)

Table 3: Countries That Play A Major Role In Electric Vehicles

According to detailed research, " The jet flame, caused by thermal runaway, accelerates the fire spread to other combustibles of battery electric vehicles. And uncertainties, induced from unforeseen thermal runaway and reignition, make a major risk to first responders. "(Kang et al., 2023) electric car batteries have high risk of fire.

Although we hear that battery-powered vehicles often get stuck on the road and do not work in cold climate conditions, and this is dangerous for human life, another important danger is that batteries can catch fire and once they burn, it is very difficult to extinguish them.

During the testing phase, the fires in battery electric vehicles burned for about 70 minutes, leading to significant measurements including the peak heat release rate (pHRR), total heat released (THR), fire growth parameters, and the average effective heat of combustion. These values were found to be 6.51–7.25 MW, 8.45–9.03 GJ, 0.0085–0.020, and 29.8–30.5 MJ/kg, respectively. Kang (2023) further noted that the pHRR and THR were influenced more by the combustion properties of typical materials found in the passenger cabin, which is often filled with plastic and other flammable substances, rather than the specific contents of the lithium-ion battery packs undergoing thermal runaway. Moreover, a jet fire emerging from the battery packs caused rapid flame to spread nearby combustible elements in the battery electric vehicles, thus accelerating the fire's growth (Kang et al., 2023).

5.2. The Rise of Chinese Hegemony in the Global Car Battery Market

In recent years, the global automotive industry has witnessed a significant shift towards electric vehicles (EVs) as nations strive to reduce carbon emissions and combat climate change. At the heart of this transition lies the burgeoning market for car batteries, where Chinese companies have rapidly emerged as dominant players, shaping the dynamics of global supply chains and exerting substantial influence over the future of electric mobility.

China's ascent to hegemony in the car battery sector can be attributed to several key factors, including robust government support, strategic investments, and a relentless pursuit of technological advancement. The Chinese government has made the development of the electric vehicle industry a national priority, offering generous subsidies, tax incentives, and supportive policies to domestic battery manufacturers. This proactive approach has propelled Chinese companies to the forefront of innovation and production efficiency.

One of the primary drivers of Chinese dominance in the car battery market is the country's abundant access to essential raw materials such as lithium, cobalt, and nickel, which are vital components in lithium-ion batteries, the most common type used in electric vehicles. China's control over these resources, both domestically and through strategic investments in resource-rich regions abroad, has provided Chinese battery manufacturers with a competitive edge in terms of cost and supply chain stability.

Moreover, Chinese companies have made substantial investments in research and development, leading to significant technological advancements in battery chemistry, energy density, and manufacturing processes. This relentless pursuit of innovation has enabled Chinese battery manufacturers to produce high-performance batteries at scale and competitive prices, further solidifying their position in the global market.

The scale of China's battery production infrastructure is staggering. With massive giga factories operated by industry giants such as CATL (Contemporary Amperex Technology Co. Limited), BYD (Build Your Dreams), and LG Chem's Chinese subsidiary, the country has rapidly expanded its production capacity to meet the soaring demand for electric vehicles worldwide. These giga factories not only churn out vast quantities of batteries but also benefit from economies of scale, driving down production costs and enhancing China's competitive advantage.

Furthermore, China's dominance in the car battery market extends beyond manufacturing prowess. The country has been actively expanding its influence along the entire electric vehicle value chain, from battery production to vehicle manufacturing and charging infrastructure. Chinese companies are increasingly partnering with international automakers to supply batteries for their electric vehicle models, cementing China's position as a crucial player in the global automotive industry.

The implications of Chinese hegemony in the car battery market are far-reaching. As the world transitions towards electric mobility, China's dominance poses both opportunities and challenges for other nations. On one hand, Chinese battery manufacturers offer a reliable and cost-effective source of batteries, which could

accelerate the adoption of electric vehicles worldwide. On the other hand, dependence on Chinese batteries raises concerns about supply chain vulnerabilities and geopolitical risks, particularly as tensions between China and other major powers escalate.

In response to China's growing influence, countries and companies around the world are ramping up efforts to develop domestic battery manufacturing capabilities and diversify their supply chains. Initiatives such as the European Battery Alliance and investments in battery research and production facilities in North America aim to reduce reliance on Chinese batteries and ensure strategic autonomy in the electric vehicle sector.

In conclusion, China's rise to hegemony in the global car battery market represents a paradigm shift in the automotive industry's landscape. With unmatched scale, technological prowess, and government support, Chinese battery manufacturers have positioned themselves as indispensable players in the transition to electric mobility. However, the concentration of power in Chinese hands also raises concerns about supply chain resilience and geopolitical implications, prompting a reevaluation of global strategies to ensure a sustainable and secure future for electric mobility.

Conclusion

Green vehicles represent a promising step toward reducing the environmental impact of the transportation sector. They have the potential to decrease greenhouse gas emissions, improve air quality, and reduce our reliance on fossil fuels. However, it is essential to recognize that their environmental benefits are context-specific and contingent on various factors, including the energy grid's composition and the sustainability of raw material extraction. It is necessary to move from a luxurious lifestyle to a modest and simple style, and if necessary, even advertising should be banned in the consumption-crazy capitalist system. Consider the electronic obligation with USB-C input, which was an environmentally friendly step when the European Union wanted it. It was a successful step in combining simplicity and technology. Automobiles can also be produced with obligations such as weight limit, luxury limit, common parts requirement, and repairability. Maybe it is time to produce vehicles without big and fancy LCD screens. Make them reliable, simple, and repairable. Otherwise, just like phones, electric vehicles are increasingly competitive, are programmed to break down after 2 years, and have batteries that cannot be replaced by the user.

Also China's technological power and Africa's material resources will stand out as the two most important factors in electric vehicle production. China also has the political power to use its hegemony over electric cars to dominate the transportation sector. Gone are the days of the image that China copied technology and Chinese products were of poor quality. China's technological power should not be underestimated, they are now completely pioneers.

To truly maximize the environmental friendliness of green vehicles, it is crucial to address the entire lifecycle, including manufacturing, operation, and end-of-life considerations. Governments, industries, and consumers must work together to ensure that the transition to green vehicles is accompanied by sustainable practices and policies. While green vehicles can be environmentally friendly, they are not a panacea, and their benefits must be carefully considered considering the broader environmental context.

Vehicle companies can develop systems for autonomous driving of vehicles one by one. Country governments, on the other hand, can develop systems that will allow trucks to move one after the other like a train, or that will allow all vehicles to move at the same time when the green light turns on. Again, governments may pressure manufacturers to install the new system on old vehicles instead of selling new vehicles with the new system installed. Consider how inefficient the products would be if every product did not have a 2-year warranty. Perhaps, after calculating the consequences, automobile companies may be forced to have a warranty of more than 3 years.

In conclusion, green vehicles are a valuable tool in the fight against climate change and air pollution, **but their true environmental friendliness depends on a holistic and environmentally responsible approach throughout their lifecycle. It will also be necessary to pay attention to where each part in production comes from, where it will go, and its recyclability.**

Conflict of Interest: The authors declare that they do not have a conflict of interest with themselves or other third parties and institutions.

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