**ENG3004 Assignment 2**

Name: Lau Chun Ho

Student ID: 19054311D

Professor: Dr Fung

**Q2)** **Is electric vehicles (EV) paving the way to a greener future? Each EV Li-ion battery needs 15kg of cobalt and over two third of the world’s cobalt are mined in the Democratic Republic of the Congo. According to this report, 40,000 Congolese children work in the cobalt mining every day. If spent battery ends up in a landfill, its cells can release problematic toxins, including heavy metals. And recycling the battery can be a hazardous business.**

Electric vehicles (EV) are powered by electricity instead of fossil fuel, such as gasoline and diesel fuel, by using rechargeable batteries to store energy. The electrical energy is converted to power by the electric motor of the vehicle.

EV are generally considered as cleaner and more environmental-friendly alternatives than traditional fossil fuel vehicles as EV produce no tailpipe emissions and lower greenhouse gas emissions. Also, electrical energy is used such that batteries of EV can be recharged by renewable energy sources, such as solar or wind power. This can further reduce the carbon footprint of travelling. However, there are controversies opposing the raising trend of the EV due to different concerns, such as source of the battery material, environmental impact for the retired batteries, etc.

In terms of professionalism, an engineer is suggested to follow ethical standards and cooperate social responsibility when reaching their objectives. For the controversy of the material used for the EV battery, the usage of cobalt has extended to exploitation of child labours during the extraction process of cobalt. The United Nations Conference on Trade and Development (UNCTAD, 2020) estimated that 40,000 children are working in extremely dangerous conditions with insufficient safety equipment and unreasonable wages during the mining process of cobalt in Southern Katanga. To solve the issue, the Democratic Republic of the Congo (DRC) government has promoted free primary education and banned child labour for dangerous work in order to eliminate child labour for mining (UNCTAD, 2020). In terms of protection of human rights, the use of materials which are extracted by inhuman ways should be reduced. Currently, the critical point for deciding whether EV contribute to future development is the effectiveness of the DRC government’s policies for eliminate child labour problem for cobalt mining and global organisations should continuously monitor the situation change. Moreover, development of alternative materials and designs for EV batteries can further relief the human rights concern for EV development.

In terms of economic perspectives, the development of EV has numerous economic benefits. As electrical energy is used for EV, fuel cost can be reduced for private vehicles as gasoline or diesel fuel for traditional vehicle are more expensive than the cost for electricity generation. The United States Energy Information Administration (USEIA, 2023) stated that the cost for EV is around one-third of the fuel cost for traditional vehicles. Moreover, due to the EV’s more simplified design for the vehicle structure, the maintenance cost for EV is generally lower than that of the traditional vehicles.

In terms of environmental perspectives, the EV can reduce carbon emissions and the use of unrenewable energy. Electrical energy, which can be generated in greener ways, is used to replaced fossil fuels, such as gasolines and diesel oil. This can reduce the carbon footprint for people when travelling. With less carbon emissions, greenhouse effect created by greenhouse gases can be reduced, in order to ease the problem of global warming. Moreover, the use of EV can also reduce the emissions of acidic gases, for example sulphur dioxides and nitrogen oxides, which will cause acid rain and create numerous environmental problem, such as damage of ecological system and damage to agricultural industries. However, there has been environmental concerns that the retired batteries for EV may cause the problem of leakage of heavy metals to the land. To solve this problem, many experts and governments have been investigating the possibility of the second life of the retired batteries for EV, such as providing grid services and residential use for storing electricity from solar power and wind power (Al-Alawi et al., 2022). With the possibility of reusing the retired batteries, leakage of heavy metal due to disposal of the batteries can be reduced.

In terms of the public health and safety, the use EV contributes both benefits and potential threats. For benefits, the use of EV is a cleaner travelling option as it can reduce the emissions of particulate matters, which may cause respiratory diseases if people inhale them into their lungs, and toxic gases such as carbon monoxides, However, due to the component of the EV batteries, the recycling process of the batteries involves various kinds of toxic heavy metals, such as lithium, cobalt, and nickel, and other chemicals from the electrolyte . During the process, if these chemicals are not handled properly, there will be potential safety threats due to the leakage of these mentioned chemicals and the high temperature involved may cause the chemicals in the electrolyte to evaporate and release toxic gases, threatening the safety of the workers of the recycling industry. Moreover, the use of batteries for EV is another safety concern. With potential design deficiencies, the batteries of EV may overheat, which may cause the batteries to catch fire or even explode, if they are damaged, overcharged and improperly used. To solve its potential threats, it is essential for the EV manufacturer to intensively monitor EV’s in terms of user’s safety and provide standard procedures and equipment standards for EV batteries recycling industries in order to reduce safety risks.

In terms of legal perspectives, the development of EV has raised various issues for both users, manufacturers and the related industries. For the users, the government should forbid improper disposal of the EV batteries as this may cause leakage of toxic chemicals and land pollution. Moreover, although the use of EV can reduce carbon emissions, carbon emission can be further reduced if people use more public transport. Current tax discount for EV in Hong Kong may encourage more people to use private cars instead of public transport. The HK government should regularly review the impact of the related policies, for example the proportion of EV usage, that of traditional vehicles and that of public transports. For manufacturer and related industries, regulations on EV safety, covering areas such as safety of the batteries, infrastructure for recharging batteries and security of the EV control system, are required to protect the consumers’ interest. Also, manufacturing and recycling process should be regulated in order to protect the safety of the workers and control its environment impact.

**References:**

United Nations Conference on Trade and Development. (2020). *COMMODITIES AT A GLANCE - Special issue on strategic battery raw materials.* [https://unctad.org/s-ys­tem/files/official-document/ditccom2019d5\_en.pdf](https://unctad.org/s-ystem/files/official-document/ditccom2019d5_en.pdf)

United States Energy Information Administration. (2023). *Gasoline and Diesel Fuel Update.* <https://www.eia.gov/petroleum/gasdiesel/>

Al-Alawi, M., Cugley, J. & Hassanin, H. (2022). Techno-economic feasibility of retired electric-vehicle batteries repurpose/reuse in second-life applications: A systematic review, *Energy and Climate Change,* 3(1), 100086. <https://doi.org/10.1016/j.egycc.2022.100086>